cap 3 NOV 2 1934

NOVEMBER

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

Zinc Phosphate Cements—*Paffenbarger, Sweeney and Isaacs*
Vincent's Infection—*Puterbaugh*
Ankylosis of Temporomaxillary Joint—*Risdon*
Local Anesthesia—*Miller*
General Anesthesia—*Stowell*
Lingual Arch in Malocclusion—*Bach*
Oral Hygiene and Preventive Medicine—*Galdston*
Newer Denture Materials—*Barber*
Oral Surgery and General Practitioner—*Christiansen*
Evolution of Orthodontia—*Weinberger*
Revised List of Dental Materials—*Messner*
Zinc Oxide Impression Pastes—*Ross*

EDITORIALS
Care for the Indigent—Soul of the Profession—Innervation of Dentin

COUNCIL ON DENTAL THERAPEUTICS
Hypersensitive Dentin—*Grossman*
Nonacceptable Remedies

BUREAU OF PUBLIC RELATIONS
Anesthesia for Children—*Sherman*

FIFTY CENTS

CONTENTS

B. F. Thielen, D.D.S. ..... Frontispiece

ORIGINAL COMMUNICATIONS

Zinc Phosphate Cements: Physical Properties and a Specification.
By George C. Paffenbarger, D.D.S.; W. T. Sweeney, A.B., and Aaron Isaacs, B.S. 1907

Vincent's Infection.
By P. G. Puterbaugh, M.D., D.D.S. 1924

Ankylosis of the Temporomaxillary Joint.
By Fulton Risdon, M.D., D.D.S., F.R.C.S. 1933

Local Anesthesia.
By Howard C. Miller, D.D.S., F.A.C.D. 1937

General Anesthesia.
By C. F. B. Stowell, D.D.S. 1943

Application of the Lingual Arch in the Treatment of Malocclusion of the Teeth.
By Ernest N. Bach, D.D.S. 1951

Oral Hygiene and Preventive Medicine.
By Iago Galdston, M.D. 1963

A Lower Full Denture with Porcelain Roots: Report of a Case.
By George A. McMonagle, D.M.D. 1968

Preliminary Tests of Some of the Newer Denture Materials.
By Roland Barber, D.D.S. 1969

Dental and Medical Practice.
By Ernest E. Irons, M.D. 1986

Problems in Oral Surgery of Interest to the General Practitioner.
By George W. Christiansen, A.B., D.D.S. 1989

Cyst Obliterating the Antrum: Report of Case.
By Nathan Kaplan, D.D.S. 1999

Historical Résumé of the Evolution and Growth of Orthodontia.
By Bernhard Wolf Weinberger, D.D.S. 2001

The Penetrometer in Dental Roentgenography.
By Louie T. Austin, D.D.S. 2021

Pulpectomy.
By W. Clyde Davis, A.M., M.D., D.D.S. 2024

Revised List of Dental Materials Certified to the Research Commission of the American Dental Association.
By C. T. Messner 2026

Zinc Oxide Impression Pastes.
By R. A. Ross, D.D.S. 2029

Congenital Absence of Twenty-Three Permanent Teeth: Report of Case.
By Boyd S. Gardner, D.D.S., and Joseph L. Dillery, D.D.S. 2032

Insertion of Silicates with the Aid of Compound Impressions.
By M. Felsher, D.D.S. 2033

National Board of Dental Examiners 2034

EDITORIAL DEPARTMENT

The Question of Dental Care for the Indigent.—The Soul of the Profession.—Innervation of Dentin.—You Might Double Your Reading 2036-2045

Obituaries: Willard S. Broomell, D.D.S. (1895-1934).—Stephen Dwight Hodge, D.D.S. (1847-1934).—Samuel Lawrence Silverman, D.D.S., F.A.C.D. (1889-1934).—Guy F. Corley, D.D.S. (1881-1934) 2045-2047

Practice in Paragraphs 2047

COUNCIL ON DENTAL THERAPEUTICS

The Treatment of Hypersensitive Dentin.
By Louis I. Grossman, D.D.S. 2050

Steridents No. 1, Steridents No. 2, Steridents "D" and Steridents Pimento Eugenol—Not Acceptable for A.D.R. 2053

Roxan for Pyorrhea—Not Acceptable for A.D.R. 2054

BUREAU OF PUBLIC RELATIONS

Conduction Anesthesia for Children.
By Joseph B. Sherman, D.D.S. 2058

Dental Health Educational Material 2063

CURRENT LITERATURE

Abstracts 2072

NEWS

State, General and Foreign News 2078

MISCELLANY

Book Reviews 2082

Correspondence 2083

Resolution of State of New Jersey Board of Registration and Examination in Dentistry 2083

Recommendations of Committee on Economics 2083

Announcements 2084

Library Bureau 2087

ADVERTISEMENTS

Index to Advertisements A-39

Classified Section A-30

The Journal of the American Dental Association, Vol. XXI, No. 11. Published by the American Dental Association, 212 East Superior Street, Chicago, Ill. Yearly subscription $3.50. Entered as second-class matter, May 1, 1928, at the postoffice at Chicago, Ill., under the act of Aug. 24, 1912. Published monthly.

Copyright, 1934, by the American Dental Association.

B. F. THIELEN, D.D.S., Paris, Texas
Vice President of the American Dental Association

UNIV. OF MICH.

THE JOURNAL
of the AMERICAN DENTAL ASSOCIATION

Vol. 21 NOVEMBER, 1934 No. 11

Original Communications

ZINC PHOSPHATE CEMENTS: PHYSICAL PROPERTIES AND A SPECIFICATION*

By GEORGE C. PAFFENBARGER,† D.D.S.; W. T. SWEENEY,† A.B., and AARON ISAACS,‡ B.S., Washington, D. C.

THIS report on some physical properties of seventeen trade brands of zinc phosphate dental cement includes: (1) data on consistency of mix, ultimate compressive strength, time of setting, disintegration in distilled water, thickness of films, density of the powders and liquids and size of the larger particles of powder; (2) studies of the adhesive and hydraulic properties; and (3) a tentative specification based largely upon data in this report.

Zinc phosphate cement was one of the materials which was investigated in the cooperative dental research between the National Bureau of Standards and the American Dental Association. This report on the physical properties of these cements is a continuation of a previous communication.[1] The same cements were studied in this as in the previous report, and they are designated by the same code letters. Thus, cement A in the preliminary report[1] is identical with cement A in this report.

Additional physical properties such as consistency of mixed but unset cement, rise of temperature on setting, adhesion to steel, gold, ivory and human tooth tissues, density of the powders and the liquids, disintegration in distilled water, thickness of films and size of the larger particles of powder were measured and are reported herein. The time of setting and ultimate compressive strength were redetermined on specimens made from

*A report to the Research Commission of the American Dental Association.

*Publication authorized by the Executive Board of the Research Commission.

†Research Associate of the American Dental Association at the National Bureau of Standards.

‡Associate Chemist, National Bureau of Standards.

1. Paffenbarger, G. C.; Sweeney, W. T., and Isaacs, Aaron: Preliminary Report on Zinc Phosphate Cements, J.A.D.A., 20:1960 (Nov.) 1933.

mixes of cement of uniform consistency.

A tentative specification was formulated for these cements. The requirements in this specification are based upon the data presented in both reports.

PREPARATION OF TEST SPECIMENS

The mixing technic employed in the preparation of all test specimens included the following details unless otherwise noted in the report: 1. The amount of powder used in 0.5 c.c. of liquid was determined by a consistency test hereinafter described. 2. The temperature of all materials and of the atmosphere in which the mixing occurred was 21 C. (70 F.). 3. The relative humidity of the atmosphere was 65 per cent. 4. The time of mixing was one and a half minutes. 5. A mass of powder representing approximately one-sixteenth of the total amount was drawn into the liquid and spatulated for ten seconds. This procedure was repeated.[1] Another portion representing one-eighth of the total amount was incorporated in the following ten seconds. A one-quarter portion was added and spatulated for fifteen seconds. This procedure was also repeated. The remaining one-quarter portion was added and the final spatulation completed in thirty seconds. 6. The mixes were made on glass slabs approximately 6 by 3 inches. Nearly one half of the top surface of the slab was used in making the mix. 7. Every portion of powder was thoroughly incorporated. No particles of powder or unused liquid were allowed to remain around the edges of the mixed portion. 8. A rotary motion of the spatula with light pressure in combination with a linear motion was used. Intermittently, the cement was picked up and deposited in a heap and the process repeated. 9. All appliances were clean and free from particles of hardened cement.

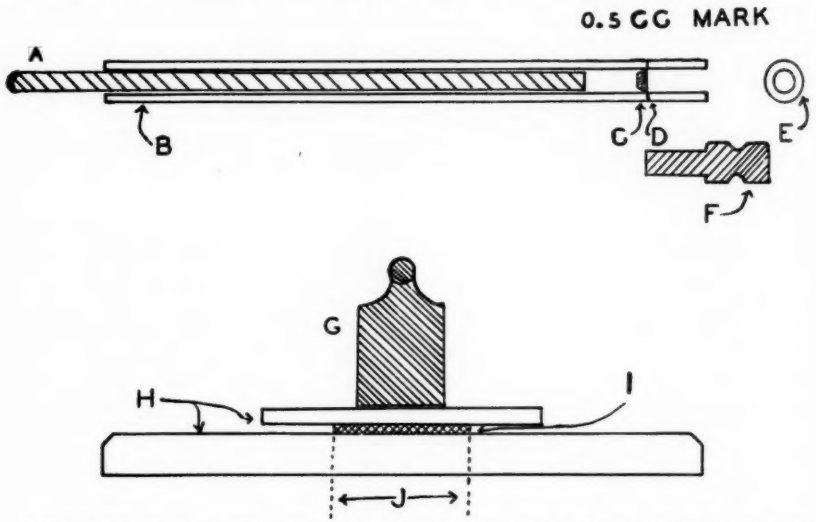


Fig. 1.—Apparatus for consistency tests. *A*, brass rod plunger; *B*, glass tube; *C*, rubber plug; *D*, cellophane disk; *E*, end view of tube; *F*, brass plug gage; *G*, 100 gm. weight; *H*, glass plates (top plate approximately 20 gm.); *I*, specimen; *J*, diameter of specimen.

CONSISTENCY OF MIXED BUT UNSET CEMENT

It is common knowledge among the users of these cements that to produce mixes of the same consistency, the amount of powder required for a given quantity of liquid will vary with different cements. If the relative merits of cements of this type are to be compared satisfactorily, it is necessary that all test specimens be prepared from mixes of the same consistency.

The designing of a satisfactory test for the determination of consistency was most difficult because the following conditions had to be considered: 1. Only a very small specimen should be used as the size of the mixes should be approximately the same as those required in actual dental practice. 2. The test speci-

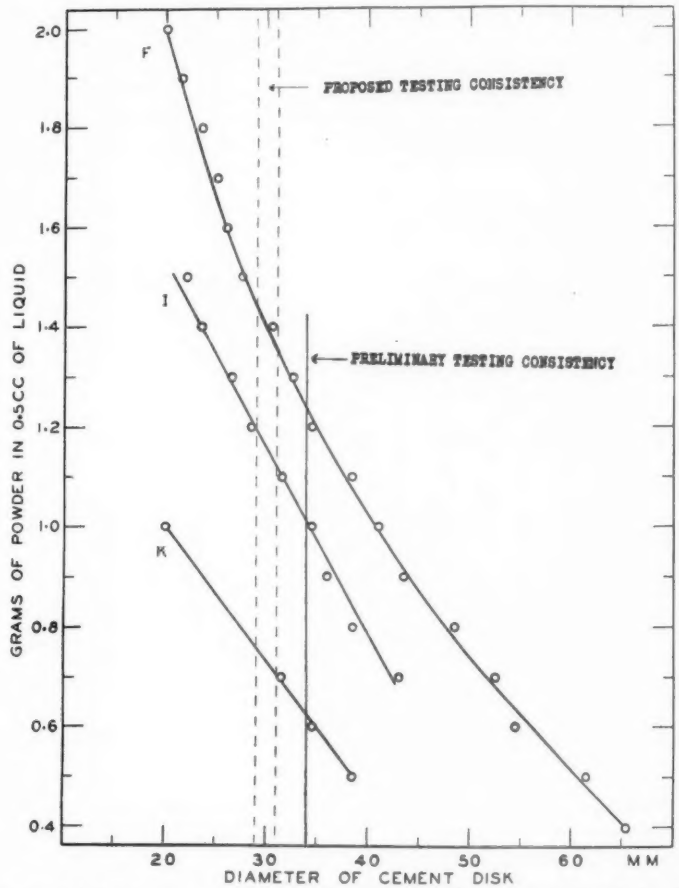


Fig. 2.—Relation between consistency and powder: liquid ratios on cement *K*, *I* and *F*.

men hardens in a few minutes and the addition of any retarding agent which would interfere with the setting would not represent conditions in actual use. 3. The soft unset cement is adhesive or sticky. This makes it difficult to measure and to deposit a definite quantity in the test apparatus. 4. The cement corrodes many metals and alloys. This must be considered in the building of the apparatus. 5. The test must be accurate, sensitive and reproducible, and must approximate closely service conditions.

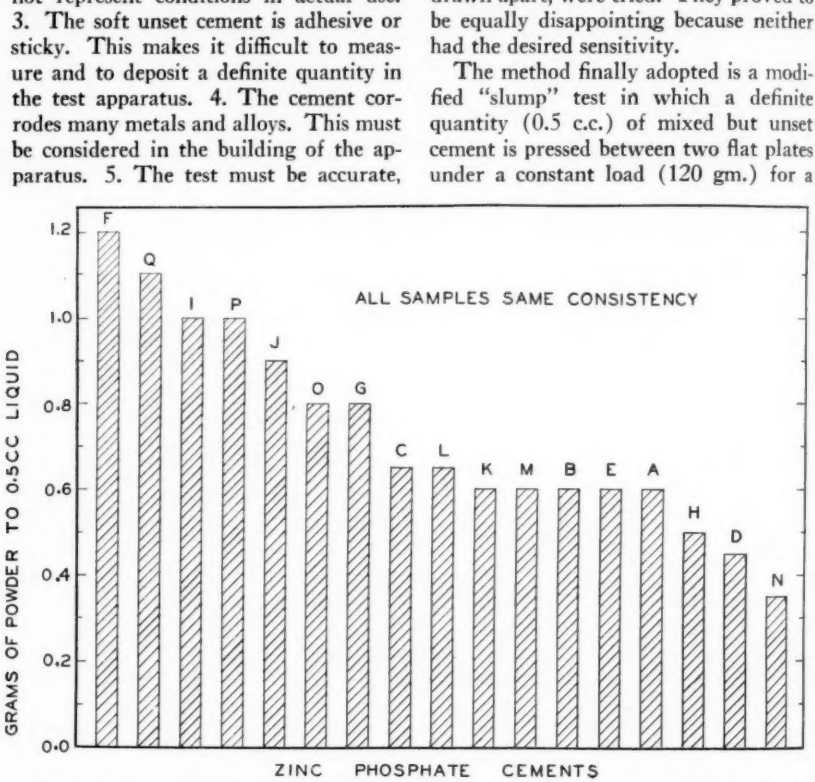


Fig 3.—Amount of powder mixed with 0.5 c.c. of liquid to give the same consistency (34 ± 1 mm. diameter disk) for the respective cements.

Several methods which are currently used in the determination of consistencies of concrete, gypsum and similar materials were tried on a small scale. They proved to be very unsatisfactory. Other methods such as observing the flow of cement down an inclined plane, and measuring the length which threads or filaments of the cement would attain before rupturing, when two surfaces with a layer of cement between them were drawn apart, were tried. They proved to be equally disappointing because neither had the desired sensitivity.

The method finally adopted is a modified "slump" test in which a definite quantity (0.5 c.c.) of mixed but unset cement is pressed between two flat plates under a constant load (120 gm.) for a definite time (ten minutes). The soft cement slumps or spreads into a disk. The diameter of the disk is used as a measure of the consistency.

The apparatus used to measure consistency is shown in Figure 1. It consists of: (1) a glass tube *B* graduated on one end to indicate 0.5 c.c.; (2) a heavy rubber plug *C* inside the tube at the calibration mark (this plug being accurately

seated by a brass depth gage *F*; (3) a thin cellophane disk *D* adjacent to the rubber plug (this preventing adherence of the sticky cement to the rubber plug); (4) a brass plunger *A* which forces the rubber plug, cellophane disk and soft cement from the tube; (5) two glass plates *H* and a 100 gm. weight *G* which press the cement between them into a disk *I*.

The method of determining the consistency is as follows: Trial amounts of powder are mixed with 0.5 c.c. of liquid. One-half cubic centimeter of the soft cement is deposited on a slab. A flat glass plate (20 gm.) and a weight (100 gm.) are placed (parallel to the bottom plate) upon the cement three minutes after the mixing was started. The soft cement spreads out into a disk between the glass plates. Ten minutes after the mixing was started, the diameters of the disk are measured.

Different consistencies of mixed cement produce disks of varying sizes. This relationship between the consistencies and powder: liquid ratios on cements F, I and K are shown in Figure 2. The curves for any of the other cements tested would fall somewhere to the left of the curve for cement F (Fig. 2), this depending on the amount of powder which could be incorporated at any given consistency.

The problem as to what consistency to select for the mixes from which specimens for other tests were to be made was given considerable thought. The manufacturers' mixing directions which accompanied the individual packages of cement were indefinite regarding consistency. Almost all of these directions recommended that the cements be mixed to the consistency desired by the individual operator. Practically the only available basis for the selection of a tentative standard of consistency was the tests made by visitors to the laboratory. These were recorded in the preliminary report.[1] The average value of these tests was selected

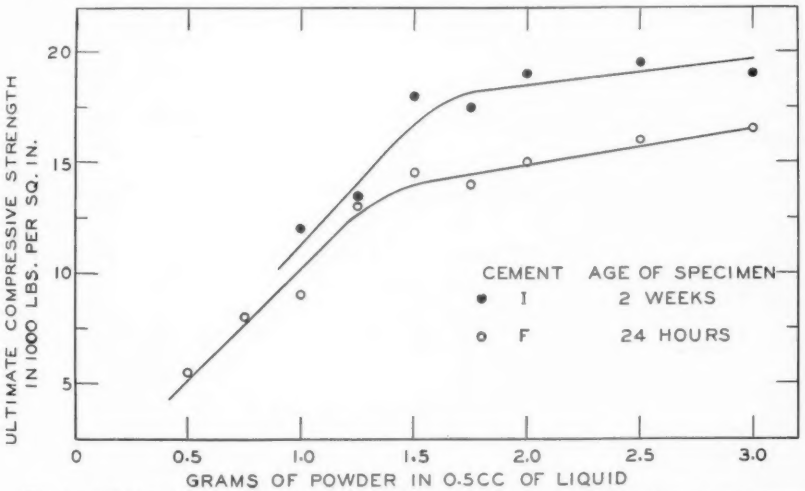


Fig. 4.—Relation between ultimate compressive strength and powder: liquid ratio on cements *F* and *I*.

as the preliminary testing consistency. This consistency produced a disk 34 ± 1 mm. in diameter. (The major and minor diameters were averaged.) The data reported were obtained on specimens produced from mixes of this consistency unless otherwise noted.

The amounts of powder in grams which could be incorporated in 0.5 c.c. of liquid to produce a consistency giving a disk 34 ± 1 mm. in diameter are given in Figure 3. It was found that, for the same consistency of mix, over three times as much powder could be incorporated in some cements as in others.

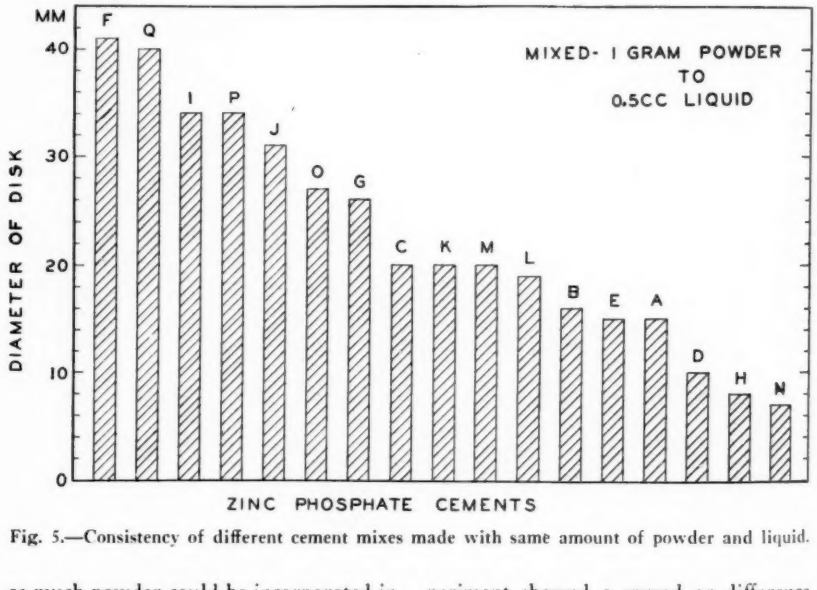


Fig. 5.—Consistency of different cement mixes made with same amount of powder and liquid.

Later (in June, 1934), consistency data were received from a group of dentists who are cooperating with the Research Commission of the American Dental Association and the National Bureau of Standards in some experiments with cements. These data were very erratic. In some instances, the spread between the reported values of individual cooperators was as high as 300 per cent. This seemed unreasonably high and the differences could not be readily explained. Tests made by us demonstrated that the commercial cements were often not uniform from batch to batch and some also varied with color. Consequently, packages of one of the commercial cements of a single batch number and color were mailed to twenty-five groups of the cooperating committee for additional consistency tests. The data from this experiment showed a spread or difference among the individual cooperators of only 50 per cent. Since these cooperating groups are located in various sections of the country, the tests were conducted under a great variety of climatic conditions. The consistencies used by the cooperating dentists in the series of experiments just mentioned produced disks having an average diameter of 30 ± 1

TABLE 1.—PHYSICAL PROPERTIES OF ZINC PHOSPHATE CEMENTS*

Cement	Powder†	Setting Time		Ultimate Compressive Strength§				Film Thickness	Disintegration in Distilled Water††	Maximum Particle Size‡‡	Temperature Rise on Setting##	Material in Bottle	
		21 C. (70 F.) 65 Per Cent‡	37 C. (99 F.) 100 Per Cent‡	One Hour		One Week						Powder	Liquid
				Kg. per Sq. Cm.	Lb. per Sq. In.	Kg. per Sq. Cm.	Lb. per Sq. In.						
1	2	3	4	5		6		7	8	9	10	11	12
	Grams	Minutes	Minutes					Microns	Per Cent by Weight	Microns	Degrees Centigrade	Grams	Cubic Centimeters
A	0.60	..#	..¶	...	.....	350	4,978	42	....	100	9	16	4
B	0.60	40	..¶	170	2,418	180	2,560	28	....	40	4	34	14
C	0.65	..#	..¶	...	.....	140	1,991	29	13.7	70	7	39	13
D	0.45	28	15	160	2,276	350	4,978	21	10.1	40	7	23	14
E	0.60	..#	..¶	...	.....	320	4,551	22	....	50	8	44	15
F	1.20	9	6	650	9,245	970	13,797	40	0.14	75	9	29	11
G	0.80	25	12	470	6,685	970	13,797	33	0.50	100	12	34	18
H	0.50	..#	..¶	...	.....	180	2,560	24	....	100	9	29	14
I	1.00	11	9	530	7,538	950	13,512	17	0.14	10	13	29	15
J	0.90	10	8	590	8,392	920	13,085	19	0.20	25	10	30	14
K	0.60	..#	..¶	...	.....	560	7,965	13	....	40	10	32	16
L	0.65	..#	..¶	...	.....	730	10,383	23	....	50	10	25	14
M	0.60	..#	..¶	...	.....	680	9,672	19	....	90	12	25	14
N	0.35	..#	..¶	...	.....	...**	.....	25	....	70	7	26	14
O	0.80	..#	..¶	...	.....	740	10,525	56	....	140	4	38	10
P	1.00	18	9	340	4,836	840	11,948	40	1.90	115	6	28	14
Q	1.10	17	7	860	12,232	1,300	18,490	34	1.90	95	6	14	7

* All data obtained from specimens made from mixes of the same consistency (34 ± 1 mm. diameter disk) and prepared in a uniform manner.
† Amount of powder necessary to mix with 0.5 c.c. of liquid to make a disk 34 ± 1 mm. in diameter.
‡ Relative humidity. # Not set at sixty minutes. ¶ Not set at fifteen minutes.
§ Values reported to nearest 10 kg. per square centimeter and the exact equivalent computed in pounds per square inch.
** Not set at one week. †† Specimens immersed for one week. ‡‡ Average of maximum linear dimension recorded.
Mixed at 21 C. (70 F.) and 65 per cent relative humidity and placed in atmosphere of 37 C. (99 F.).

mm. Consistency such that disks of this diameter will be produced has been incorporated in the proposed specification as the standard consistency for these cements because: (1) it is representative of office practice throughout the country; (2) it has theoretical justification as

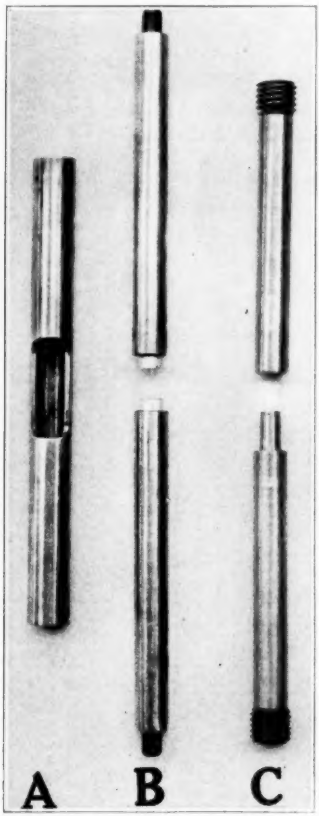


Fig. 6.—Apparatus for studying adhesion of cement.

shown in Figure 4. Increasing the powder:liquid ratio of the mix beyond the foregoing value is hardly justified because the crushing strength would be only slightly increased, and this small advantage would be far outweighed by the increased difficulty in accurately seating appliances.

Most of the test specimens in the preliminary report[1] were made from mixes in which 1 gm. of powder was combined with 0.5 c.c. of liquid. The great variance in the consistency of such mixes among the different cements is shown in Figure 5. All of the cements, except those designated by the letters F, Q, I and P, had a distinct advantage when the test data were compared, because they were mixed relatively thicker.

The consistency test will be found very useful in developmental work and in factory production control because it is accurate, simple and rapid and does not require complicated and expensive apparatus.

TIME OF SETTING

The setting time of all of the cements was determined on specimens made from mixes of uniform consistency (34 ± 1 mm. disk) by the method described in the preliminary report.[1] The determinations were made under two sets of conditions: (1) in an atmosphere of 65 per cent relative humidity at 21 C. (70 F.) and (2) in an atmosphere of 100 per cent relative humidity at 37 C. (99 F.). The data are given in Table 1, columns 3 and 4, respectively.

ULTIMATE COMPRESSIVE STRENGTH

The compressive strengths of all of the cements were determined on specimens made from mixes of uniform consistency (34 ± 1 mm. disk). The details of the preparation of the specimens and test method were reported previously,[1] and will not be repeated here. The values for specimens 1 hour old and 1 week old are given in Table 1, columns 5 and 6, respectively.

PARTICLE SIZE OF POWDER AND FILM THICKNESS

The particle size of cement powder has received considerable attention during the last few years in advertising and sales promotion. Powders of extreme fineness in which the maximum linear dimension of the larger particles does not exceed 10 microns (0.0004 inch approximately) are on the market. Cements using such fine powder have adequate strength and do not react violently when the powder and liquid are spatulated. In fact, they may be stronger and have better working qualities than the cements made with coarser particles, some of which are as large as 100 microns in maximum dimension. The finer powder has relatively more surface area, and we would expect the speed and heat of the reaction between the powder and the liquid to be greater than with a coarser powder. These factors seem to have been satisfactorily controlled by some manufacturers who furnish very fine powders for their cements.

Particle size of powder, from the dental standpoint, is of importance only in relation to film thickness. Many dental appliances such as cast crowns and inlays are now very accurately made. The proper seating of such appliances requires a thin layer of cement.

The method used in determining the

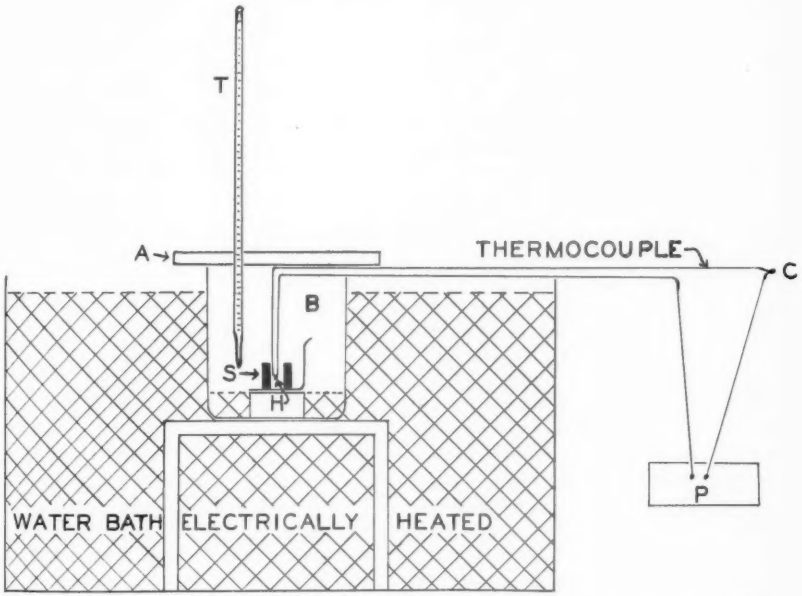


Fig. 7.—Apparatus for determining temperature rise of dental cement during setting. *T*, thermometer; *A*, top cover for beaker; *B*, 100 c.c. beaker; *S*, specimen mold (hard rubber); *H*, hot junction of thermocouple (in cement); *C*, cold junction of thermocouple (in water-ice bath); *P*, potentiometer for measuring EMF of thermocouple.

film thickness is somewhat similar to that used by Head.[2]

Some preliminary tests conducted by dentists showed that the maximum load which could be conveniently maintained for several minutes in seating crowns and inlays was about 7 kg. (approximately 15 pounds). The surfaces of most appliances which are in contact with the cement are usually 1 sq. cm. or less. More extensive pieces, such as bridges involving several abutments, would have more surface in contact with the cement. The maximum surface involved in the cementing procedure, for the purposes of this test, was assumed to be 2 sq. cm. (approximately 0.30 square inch). The load used was therefore 14 kg. (approximately 30 pounds).

A portion of a mix of cement of preliminary consistency (such as to produce a disk 34 ± 1 mm. in diameter) was placed between two pieces of clear glass 2 cm. long and 1 cm. wide. The pieces of glass were flat and of uniform thickness. The mix was completed in one and a half minutes and the same time was consumed in placing the cement on the glass surfaces. Three minutes after the mix was started, the load (14 kg.) was applied vertically on the top plate. Seven minutes later, the thickness of the plates with the cement film between them was measured with a micrometer. The difference between this measurement and the original thickness of the glass plates was taken as the film thickness. The average of three tests on each cement is shown in Table 1, column 7.

Head[2] demonstrated that there was a relationship between the size of the larger particles and the film thickness. The reason for such a relationship is that the larger powder particles are only partially dissolved by the liquid and remain in the mix in much the same manner as pebbles in concrete.

The larger particles of all of the cement powders were measured in the following manner: One gram of powder was water-floated to remove finer particles. The residue of the larger particles was separated from water by filtration and dried. A small sample of this residue was placed upon a microscope slide with a drop of cedar oil. The powder was dispersed in the oil by rubbing the mixture between a cover glass and the slide. The maximum linear dimensions of ten of the larger particles were measured with a micrometer microscope. The average of these is shown in Table 1, column 9. There is a general trend indicating that the film thickness is based on particle size.

DISINTEGRATION

The solubility and the erosion of an oxyphosphate cement by the action of water are very important properties, since the permanence of the cement is dependent on these properties. The solubility of a cement in water or saliva is of little value, considered alone, but, when combined with the resultant disintegration of the cement, this characteristic can be used as a measure of the permanence of the cement. The combined effect of solubility and erosion has been called the disintegration of the cement.

There are many factors in the disintegration of the zinc phosphate cements. Among these are the inherent properties of the cement itself (all cements of this type are soluble to an appreciable extent), the technics used in preparing the test specimens and the methods used in studying the disintegration.

Any test must of necessity be largely empiric, but if all cements are subjected to the same conditions during the test,

2. Head, Joseph: Modern Dentistry, Ed. 2 (Chapter XI), Philadelphia: W. B. Saunders Co.

the results obtained from a series of tests of various samples of cement should give a fair idea of the stability of the cements when mixed under the conditions of the test. From theoretical considerations, there seems to be no reason to expect the results obtained from the study of the action of water to be markedly different from those obtained with either natural or artificial saliva. For this reason, the study was made using distilled water as the disintegrating agent.

As all data in this paper are based on mixes of cement powder and liquid that have a uniform consistency (34 ± 1 mm. disk) after mixing, the same ratio of powder to liquid was used for making the disks that was found to give such a consistency. Some cements did not set in one hour when mixed to this consistency. Now it is apparent that an unset cement will not only be useless as a cementing medium, but will also give very different results from those that would be obtained if the cement were mixed in such manner that the final product would set. Therefore, in these tests, results are reported on only those samples that set to a rigid mass in one hour.

One-half cubic centimeter of mixed cement was used to form each pat. The mixed cement was then placed on a glass plate. A piece of dental floss was placed on it and then, by means of another glass plate, the cement was pressed into a disk 20 mm. in diameter. The plates with the cement between them were then placed in an oven at 37 C. and left there for one hour. After removal from the oven, the glass plates were removed. The piece of dental floss previously inserted was used as a means of suspending the samples. Two such disks were used for each determination. The weight of the disks minus the weight of the dental floss was taken as the weight of the sample of cement. The samples were then completely immersed in 100 c.c. of distilled water held in an accurately weighed stoppered flask for a period of seven days at 37 C. At the end of this time, the samples were withdrawn from the flask and the water remaining in the flask was evaporated. The flasks were then dried by being placed in an oven at 150 C., until there was no further loss in weight. The gain in weight at this final weighing over the weight of the empty flask was taken as the amount of disintegration of the cement and this weight divided by the original weight of the sample times 100 was taken as the percentage of disintegration. Duplicate determinations were made (two flasks containing two disks each) and the average was taken as the measure of disintegration of the cement.

The values found for the samples tested are given in Table 1, column 8.

ADHESION

Several manufacturers claim their zinc phosphate cements are adhesive and many practitioners believe this to be true. This property has often been considered of paramount importance in the retention of inlays and other appliances. Cements of the silicious type are said to be non-adhesive. This distinction is probably based upon the fact that the zinc phosphate cements are sticky or "tacky" in the soft unset state and easily wet surfaces to which they are applied, while the silicious type do not. This is probably a matter of surface tension as the silicious cements have a greater tendency to become spheroidal or round than the zinc phosphate cements. This is especially noticeable in the preparation of test specimens. The zinc phosphate cements flow into the molds with comparative ease, while the silicious type tends to entrap air and to produce specimens with rounded corners. When the zinc phos-

phate cements harden, they no longer adhere to gold, steel, ivory or human tooth tissue. While cements which do not completely harden or set in a few minutes appear adhesive, they posses many inferior qualities, such as low crushing strength and great susceptibility to disintegration.

Two appliances which were used to determine the degree of adhesiveness are shown in Figure 6. Appliances *A* and *B* (Fig. 6) are two brass rods with a brass tube for alining the specimen for tensile tests. One end of each rod is threaded so that it may be mounted in a testing machine. The other ends have inserted pieces of ivory with faces flat and perpendicular to the axis of rods. In making the tests, the whole appliance was submerged in water until the ivory was thoroughly wet. It was then wiped dry and the cement was applied between the ivory pieces and held there under pressure until set. The cement joint was then immersed in water overnight. The bond between the cement and the ivory was so weak that it would break before it could be mounted in the testing machine. Human teeth were ground flat on one side, immersed in water and wiped dry, and cement was applied. After hardening, the cement could always be easily dislodged from the tooth.

Some tests for measuring adhesiveness of dental cements have been reported. Practically all of these tests measure the load necessary to dislodge a plug or crown from a block or die. The tests usually show that a considerable load is required to dislodge the plug or crown. One such type of test, using appliance *C* (Fig. 6), was used in this study. This appliance consists of two steel rods, one end of each rod being threaded for mounting in the testing machine, and the other ends formed into a truncated cone representing a molar crown preparation and a crown which fits over this. Both are highly polished. Cement M was selected for this test because it had been found to be the most difficult of all the cements to remove from the molds. The two ends were cemented together and, after the cement had set, the whole device was immersed in water overnight. It was then mounted in an alining device, placed in the testing machine and pulled until rupture occurred. A load of about 1,300 pounds was required to separate the pieces. This was considerably more than was anticipated. As a check test, cement powder and water were mixed and used in assembling the device. Again, a load of approximately 1,300 pounds was required to separate the crown from the truncated cone. It seems that what was actually being measured was not the load required to overcome the adhesive force of the cement, but the shearing or crushing strength of the cement powder particles. Practically any value could be obtained, depending on the roughness of and shapes of the surfaces and the size and shape of the particles. This test also seems to explain why appliances are often very difficult to remove. The cement simply flows into all of the minute irregularities of the cavity and of the appliance and locks the inlay in place. When the appliance is dislodged, the cement is crushed or sheared. Thus, the compressive strength is an important property in retention. If the cement film is only one particle thick, the crushing strength of the individual particle would seem to be an index to the force necessary to remove the inlay or appliance.

HYDRAULICITY

The term "hydraulic" has been very loosely used in advertising and in the literature regarding cement of the zinc phosphate type. Such terms as "a thor-

oughly hydraulic cement" and "warranted hydraulic" are frequently encountered. If a cement were actually hydraulic, it would not only harden under water, but would also become impervious to the action of water. Since cements of this type have been termed hydraulic, it is sometimes assumed that saliva may be, or, in fact, should be, allowed to flow over the cement before it has set. Despite this popular idea, cements of this type need to be protected from saliva until setting has taken place; otherwise, they will be damaged. Phosphoric acid has a great affinity for water. If the cement is placed in water, or wet with saliva before the initial set has occurred, the acid is leached out, the cement becoming chalky and permeable. Most of the manufacturers realize the effect of premature contact of the cement with water or saliva and caution the operator against such practices.

If a mix of any of the zinc phosphate cements is divided into two portions, one of which is permitted to harden under water, while the other hardens in air, the enormous difference in the quality of the two portions will be evident. The portion which hardened in air presents a glossy surface. The surface of the other portion has a dull frosted appearance and is penetrated comparatively rapidly by dyes or stains.

TABLE 2.—COLOR AND DENSITY OF CEMENTS

Cement	Color of Powder	Density Gm. per Cubic Centimeter at 25 C.	
		Powder*	Liquid
		1	2
A	No. 1	5.65	1.84
B	Light	5.64	1.68
C	Cream white	5.67	1.65
D	Light yellow	5.65	1.72
E	Light yellow	5.35	1.63
F	Light gray	5.22	1.68
G	Light yellow	5.17	1.61
H	Light yellow	4.54	1.66
I	Grayish brown	5.16	1.56
J	White	5.22	1.56
K	Light	5.19	1.62
K	Golden yellow	5.29	
L	Pearl gray	5.53	1.64
M	Pearl gray	5.12	1.65
M	Golden brown	5.14	
N	Light	5.29	1.67
O	Light yellow	4.93	1.77
P	Light	4.63	1.53
Q	Light yellow	2.69†	1.51
Q	Light yellow	2.59†	

*The values for the powders are believed to be correct to within ± 0.02.

†The two values are given because of the discrepancy between them. This powder is a physical mixture of two separate powders.

DENSITY

The true density of cement powders has often been considered an important criterion in determining quality. The denser powders were thought to produce a cement which would resist disintegration to a greater extent than cements made from less dense powders.

The results of duplicate determinations of density on the cement powders are shown in Table 2, column 1. The powders having particles of greatest density appeared to produce inferior cements which had low crushing strengths and were slow in setting. Only a relatively small amount of powder can be used in making a mix to any desired consistency with such cement.

The densities of the respective liquids are shown in Table 2, column 2. These determinations were made in the capacity and density section's laboratory by S. Alpher.

TEMPERATURE RISE ON SETTING

All the cements tested showed an exothermic reaction on mixing, that is, all the specimens gave off heat owing to the chemical reaction incident to setting. The temperature to which a given specimen of cement will rise is dependent on many conditions most of which are in control of the operator. By varying the rate of incorporation of powder in the liquid, the amount of spatulation and the various other conditions, the temperature may be kept down.

A method for determination of the temperature rise of cement was selected which duplicates as nearly as practicable the oral condition.

The diagram in Figure 7 shows an outline of the set-up.

All the specimens were mixed to the same consistency (34 mm. disk) in a room held at constant temperature (21 C.) and humidity (65 per cent). The material was mixed one and one-half minutes, then the hard rubber mold one-half inch long by one-quarter inch in diameter, having a wall thickness of seven-sixteenths inch, was filled and stroked off level to the top of the mold.

Three minutes after starting the mixing, the mold was placed in the container, which had previously been regulated to 37 C. and saturated humidity. A thermocouple was placed in the central portion of the specimen and the temperature change in the cement was measured by observing, by means of a potentiometer, the change in the electromotive force of the couple. Number 36 chromel and constantin wires were used for the couple. Table 1, column 10, shows the rise in temperature for each cement tested. Each value is the average of two runs. This test requires very close control and the results are considered good to approximately 2 degrees C.

The maximum temperature was reached in most of the samples between three and eight minutes after the start of the mix. The range of the rise in temperature above 37 C. for all of the cements was between 4 and 13 C. inclusive. This would undoubtedly have been greater if a considerable amount of heat had not been absorbed by the mold. Considering the large amount of cement used in these tests, it is thought unlikely that any serious trouble will result from this rise in temperature of the small amounts of cement (when properly mixed) used for placing dental appliances.

SPECIFICATIONS

The following tentative specification for cements used in setting appliances is largely based upon the test data of seventeen brands of zinc phosphate cements as reported in this and in a previous paper.[1] This specification was

forwarded to manufacturers, dental schools and members of the cooperating committee of dentists for their suggestions and criticisms. The cooperating committee has contributed valuable data as to the correct consistency.

AMERICAN DENTAL ASSOCIATION
TENTATIVE SPECIFICATION NO. 8
FOR
DENTAL CEMENTING MEDIUM

(Effective July 1, 1935)

A. General Specification: This specification is for dental cements the primary uses of which are:

A-1. To join or to seal dental appliances to oral structures or to other appliances.

A-2. To serve as a base or foundation for other filling material.

A-3. To serve as a temporary filling material.

B. Types: Only one type of material is specified. The consistency of the mix which different uses require can be varied by the individual operator to suit his own needs.

C. Material: C-1. These cements shall consist of a powder and a liquid which, when mixed in the proper manner, will harden or set.

C-2. The powder and liquid shall be uniform and free from poisonous foreign materials.

C-3. Colors for the set cement shall be specified by the purchaser.

D. General Requirements: D-1. The liquid shall be free from cloudiness, precipitates, deposits or sediment.

D-2. Cements when spatulated in the proper dental manner shall not:

D-2a. Form lumps or granules.

D-2b. Evolve gas.

D-2c. Contain known pulp devitalizing agents such as arsenic.

D-2d. Discolor tooth structures.

E. Detail Requirements: E-1. Time of setting. The time of setting shall not be less than four nor more than ten minutes.

E-2. Ultimate Compressive Strength. The ultimate compressive strength shall not be less than:

E-2a. 350 kg. per square centimeter (approximately 5,000 pounds per square inch) for specimens crushed one hour after mixing.

E-2b. 840 kg. per square centimeter (approximately 12,000 pounds per square inch) for specimens crushed seven days after mixing.

E-3. Film Thickness (see paragraph I). The film thickness shall not exceed 0.05 mm. (0.002 inch).

E-4. Disintegration (see paragraph J). The disintegration of the cement shall not exceed 1.0 per cent by weight after immersion for seven days in distilled water.

F. Methods of Inspection and Test: F-1. Preparation of Test Specimens. The preparation of the test specimens shall be conducted at a temperature between 65 and 75 F. and at a relative humidity between 55 and 75 per cent. The powder:liquid ratio used shall be determined by the consistency test. The mixing technics employed in the preparation of all test specimens shall be those which accompany the packages of cement except that the temperature and humidity may vary within the foregoing limits.

All apparatus and instruments shall be clean, dry and free from particles of hardened cement.

F-2. Testing Consistency. One type of apparatus for measuring consistency is shown in Figure 1. This apparatus consists of a glass tube (inside diameter approximately 6.5 mm.) which will deliver a definite volume (0.5 c.c.) of mixed cement, two flat plates and a weight. (The combined weight of the top plate and the weight shall be 120 gm.)

F-2a. Trial amounts of powder are mixed with 0.5 c.c. of liquid. Then 0.5 c.c. of mixed but unset cement is placed in a measuring device and deposited on a flat glass plate. Three minutes after the mix is started, another glass plate (weighing approximately 20 gm.) and the additional weight shall be carefully placed on the soft cement. Trials shall be made until the average of the major and minor diameters of the slumped mass of cement shall be 30 $\pm$ 1 mm. ten minutes after starting the

mix. The average of the amounts of powder used in three such determinations shall be the amount of powder (combined with 0.5 c.c. of liquid) necessary to produce a mix of standard consistency.

F-3. The tests for arsenic and similar poisonous materials shall conform to those designated by the United States Pharmacopeia (current edition).

G. Time of Setting: A ring 5 mm. high and 10 mm. in diameter is placed on a flat plate and filled with cement of standard consistency. Three minutes after the mix is started, the specimen is transferred to an atmosphere of 100 per cent relative humidity at 99 F. A standard Gillmore needle (weighing 1 pound and having an end one-twenty-fourth inch in diameter) is lowered vertically until the surface of the cement is touched. This is repeated at frequent intervals. The time of setting shall be the number of minutes elapsed from the starting of the mix to the time when the needle fails to make a perceptible circle on the surface of the specimen. The setting time shall be reported to the nearest minute.

H. Ultimate Compressive Strength: A cylindrical mold 12 mm. high and 6 mm. in diameter is placed on a flat plate and slightly overfilled with cement of standard consistency. A second flat plate is pressed on top of the mold to remove excess cement. The molds shall be made of hard rubber, glass or other substance that will not be corroded by the cement. (Painting the molds with a thin solution of a hard wax in benzene will facilitate removal of the specimens.) Three minutes after the mix is started, the molds are transferred to an atmosphere of 100 per cent relative humidity at 99 F. Thirty minutes later, the specimens are immersed in distilled water at room temperature.

The ends of the cylinder shall be surfaced plane at right angles to the axis. The ends of the specimens may be ground flat by the use of a small amount of carborundum powder (200 mesh) and water. The molds containing the specimens are drawn back and forth across a glass plate coated with the abrasive and water. They should be rotated about one-fourth turn every few strokes. The test specimens shall be kept wet during the grinding and until after crushing. The machine used in crushing the test specimens shall be operated at a rate of speed which will move the crushing head 0.25 mm. per minute.

The value for compressive strength shall be reported as the average of three or more from a lot of five specimens and shall be rounded off to the nearest 10 kg. per square centimeter (150 pounds per square inch). If the values for individual specimens vary more than 15 per cent from the average, they shall be discarded and the average of the remaining specimens shall be reported. In case more than two of the specimens are eliminated, the test shall be repeated.

I. Film Thickness: A portion of a mix of standard consistency is placed between two flat square or round plates of uniform thickness. The surfaces of the plates between which the cement is spread shall be approximately 2 square centimeters. Three minutes after the mix is started, a load of 15 kg. shall be applied vertically on the top plate.

Ten minutes after the mix is started, the thickness of the two plates with the cement film between them shall be determined. The difference in the thickness of the plates with and without the cement film shall be considered as the film thickness. An average of three tests shall be reported to the nearest 5 microns (0.0002 inch).

J. Disintegration: The disintegration of a cement is a measure of the erosion plus the extraction of soluble material from the cement by the action of water.

One-half cubic centimeter (0.5 c.c.) of cement of standard consistency is pressed between two flat plates until the cement is 20 mm. in diameter. (A piece of waxed thread placed in the soft cement before the specimens are formed provides a convenient means of holding the specimens.) Three minutes after the mix is started, the plates and cement are placed in an oven at 99 F. for one hour. Two such specimens shall be used for each determination.

After one hour, the specimens are withdrawn from the oven and quickly weighed.

The combined weight of the two, less the weight of the waxed threads, shall be taken as the weight of the specimens of cement. The specimens are immediately submerged in 100 c.c. of distilled water in a weighed stoppered flask and stored for a period of seven days at 99 F. The specimens are then removed from the water. There shall be no evidence of crystal growth or extensions from the surface of the specimen. The water is evaporated at a temperature just below 212 F. The flask is then dried at 300 F. to constant weight. The flask and contents are weighed. The difference between the final weight of the flask and its initial weight is the amount of disintegration. The gain in weight divided by the weight of the specimens times 100 gives the percentage of disintegration. The average of duplicate tests (two flasks containing two specimens each) shall be reported to the nearest 0.1 per cent.

K. Packaging: K-1. The cement powder and liquid shall be supplied in glass containers. The net weight of the powder shall be indicated on the container. The liquid shall be supplied in an amount 20 per cent in excess of that necessary to combine with the total amount of powder when mixed to testing consistency.

K-2. Adequate and accurate instructions for proportioning and manipulation shall accompany each package. These instructions shall include the temperature of the slab, the powder:liquid ratio, the rate of powder incorporation and the time of mixing.

K-3. Each package of powder and liquid shall be marked with a serial number or a combination of letters and numbers which shall refer to the manufacturer's records for that particular lot or batch of cement powder and liquid.

K-4. The date of manufacture (year and month) shall be indicated on the package as a separate item or as a part of the serial number.

L. Notes: L-1. Manufacturers of dental cements may indicate that their materials comply with this specification by: (*a*) a statement on the package guaranteeing the material contained therein to meet the requirements of this specification; or (*b*) a statement of the physical properties of the material in such detail as to cover all of the requirements specified.

L-2. The American Dental Association will not assume responsibility for, or guarantee compliance of, material so labeled by manufacturers, but will, in event of a dispute between a member of the Association and a manufacturer, act in an advisory capacity and will designate testing laboratories having equipment for testing dental

TABLE 3.—SUMMARY OF DETAIL REQUIREMENTS OF A. D. A. SPECIFICATION NO. 8 FOR DENTAL CEMENTING MEDIUM

Consistency of Mix	Time of Setting at 99 F.		Ultimate Compressive Strength		Film Thickness	Disintegration
	Min.	Max.	Min.	Min.	Max.	Max.
	Minutes	Minutes	1 Hour	7 Days		
			Kg. sq. cm.	Kg. sq. cm.	Microns	Per cent by weight
Disk 30 ± 1 mm. in diameter	4	10	350 (Lb. sq. in.) (5,000)	840 (Lb. sq. in.) (12,000)	50	1.0

cements where any necessary tests may be made.

As previously intimated it is impossible to state which cements comply with the tentative specification because the data contained herein are all from specimens made from mixes of a certain consistency (34 ± 1 mm. disk), while the specification requirement for consistency now calls for a slightly heavier mix (30 ± 1 mm. disk). It was also found that different batches of the same brand of cement were by no means identical. Some of the cements also varied widely in quality with color. Therefore, the data are applicable only to the colors and batches which were purchased for test and should not be quoted in manufacturers' advertising or other literature. It is to be hoped that the manufacturers will provide sufficient factory control to insure a constantly uniform product which will comply with the requirements of this specification and that they will so guarantee their cements. Any such guarantee or advertisement must obviously be based upon the manufacturer's data and not on those contained in this report. Such a program will adequately protect the dentist and his clients from inferior materials.

SUMMARY

1. This paper is a continuation of a previous report on the zinc phosphate cements.[1]

2. The test for determining consistency of dental cements described is simple, sensitive and accurate and does not require expensive apparatus. It will be useful in developmental work and in factory production control.

3. Such physical properties as the time of setting, ultimate compressive strength, film thickness and disintegration were measured on specimens made from mixes of the same consistency (34 ± 1 mm. disk); other properties such as adhesion, hydraulicity and density of powder and liquid were investigated.

4. The properties of the cements tested often varied from batch to batch and with color.

5. A tentative specification recommended gives definite requirements for consistency of mix, time of setting, ultimate compressive strength, disintegration and film thickness.

VINCENT'S INFECTION*

By P. G. PUTERBAUGH, M.D., D.D.S., Chicago, Ill.

VINCENT'S angina is a term quite generally employed to designate fusospirillary invasion and the resultant pseudomembranous reaction of any of the tissues of the body. Strictly speaking, the term Vincent's angina should be limited to the fusospirillary infections of the tonsils and pharynx which are characterized by sore throat. Infection of the gingival and buccal tissues with the same organisms is properly designated ulceromembranous gingivitis or stomatitis. The latter is commonly referred to as Vincent's infection or trench mouth.

Although the early writers on diseases of the mouth and throat omitted certain

*Read at the Seventieth Midwinter Clinic of the Chicago Dental Society, March 1, 1934.

important diagnostic signs, there is no doubt that Vincent's infection of the tonsils and oral tissues has existed for many centuries. Although the organisms were long unnamed, they were studied and described by the earliest students of microscopy. To the best of our present knowledge, its occurrence in epidemic form during the late World War, when hordes of the enlisted men in encampments in America as well as those in the trenches in Europe suffered at times from acute attacks of the disease, was quite unusual. Because of its widespread occurrence and extreme severity during that conflict, it received the name trench mouth. Since the war, its incidence in America has been far greater than in former times.

Two forms of bacteria are always present in this disease and are said to grow in symbiosis. The causative organisms may be readily identified in smears obtained from the active lesions. They are considered by most bacteriologists to be unrelated; but this belief has been challenged by Tunnicliff and Weaver,[1] who made the observation that spirillary organisms developed in old cultures of fusiform bacilli on artificial mediums; and, from this observation, hold the opinion that the spirillary organisms are merely developmental variants of *Bacillus fusiformis*. While the demonstration is quite convincing, the theory that the same condition occurs in tissues has not been generally accepted; although it is regarded by most bacteriologists as a possibility. The great variation in size and form of fusiform bacilli is strongly suggestive that several species of that organism may inhabit the oral cavity; which would account for some of the confusion that now exists regarding its pathogenicity.

Briefly described, *Bacillus fusiformis-dentium* occurs in spindle-shaped rods with pointed ends. It varies in size from 1.5 to 4 microns in width to from 3 to 10 microns in length. Under the microscope, it presents a granular appearance, staining irregularly with gentian violet or methylene blue and having from two to six visible granules distributed throughout its length. *Bacillus fusiformis* is nonmotile and may be cultivated on artificial mediums under anaerobic conditions.

The other bacterium omnipresent in Vincent's infection is the threadlike spirochete of Vincent. This very delicate organism has from two to five spirals, is 0.3 micron in diameter and from 12 to 15 microns in length. It is feebly motile, and, like *Bacillus fusiformis,* can be cultivated artificially only under anaerobic conditions.

Both of these organisms are common inhabitants of the mouths of the dog and cat; and, in more than one instance, both animals have been accused of acting as hosts or carriers of the disease. The organisms are also capable of existing in the mouths of many other lower animals, but are nonpathogenic except in man.

Information is lacking as to how long the organisms are capable of living outside the body. The fact that the disease is frequently transmitted by means of drinking cups, eating utensils, pencils, etc., confirms the belief that they retain their virulence under adverse conditions for a considerable period of time. Many other bacteria are present in smears obtained from every case of Vincent's infection, and that *Bacillus fusiformis* and Vincent's spirillum are the real etiologic factors has been seriously questioned. Bunting[2] states that since the clinical symptoms of the disease are never found in the absence of these organisms, "al-

1. Tunnicliff, Ruth, and Weaver, G. H.: J. Infect. Dis., 1905, 446; 1906, 148.

2. Bunting, R. W.: Textbook of Oral Pathology, Philadelphia: Lea & Febiger, 1929.

though definite proof of the specificity of these organisms has not been forthcoming, the consensus of opinion today is in support of the view that the fusiform bacillus and its accompanying spirochete are at least essential factors in the production of Vincent's disease."

Vincent's infection occurs in all parts of the world, but is most prevalent in the temperate zone. Probably because of the reduced resistance of soldiers in the trenches and their subsistence on army rations, all armies engaged in the World War became its victims. Seasonal changes have little influence on its incidence, although there appears to be a somewhat greater number of cases during the early spring months. Reckford and Baker[3] found it to be most widely prevalent in the month of February. Persons of all ages are susceptible, and children frequently contract the disease, especially when living in the same household with adults who have acquired it. It is more common in males than in females, and the widespread occurrence of Vincent's gingivitis in the mouths of cigaret smokers is strongly suggestive that the cigaret may play an important rôle in providing suitable soil for the development of fusospirochetal organisms. The high incidence of the disease in direct relation to the increased consumption of cigarets is strongly supportive evidence for this belief. It is also quite common in the mouths of women who habitually smoke cigarets, but it is rare among those who do not. From this observation, and because of the difficulty encountered in its treatment when cigaret smoking is continued, it is my opinion that the almost universal indulgence in cigarets is in a great measure accountable for the increase of Vincent's infection in recent years. Malnutrition, avitaminosis, severe metabolic disturbances and diseases of the oral tissues are important predisposing conditions.

Vincent's infection may be transmitted by either direct or indirect contact; directly, through kissing or other contacts, and indirectly, through contact with drinking cups, mouths of bottles, eating utensils, pipes, lead pencils, telephones, doorknobs, towels and unsterile hands and instruments. The organisms are implanted directly on mucous tissues, where they multiply and provoke the characteristic inflammatory reactions.

Since the organisms are anaerobic, the primary lesions of the disease are always found in protected locations, the common sites being the tonsillar crypts, gum flaps distad from lower third molars, the interdental spaces, and those previously inflamed gingival margins that are hidden beneath ill-fitting crowns, bridges or projecting edges of overhanging fillings. Edentulous mouths are relatively immune to the disease.

In its earliest stage, Vincent's infection exhibits an infiltration of the submucosa with active hyperemia and slight swelling. In the chronic, mild forms, this simple hyperemic stage persists for a long time; resulting in either a chronic marginal gingivitis or, in some patients, marked gingival hypertrophy and hyperplasia, which at times envelops one-half or more of the coronal portions of the adjacent teeth.

In the invasion, the spirilla penetrate the living tissues for a considerable depth; while the fusiform bacilli remain on the surface, playing the rôle of saprophytes and digesting the tissues that have been devitalized by the spirilla. It is interesting to note the relationship existing between the ratio of the two organisms and the character of the lesions. In those cases in which there is a preponderance of fusiform bacilli, marked ulcerative

3. Reckford, F., F. D., and Baker, M. C.: J.A.M.A., 75:1620 (Dec. 11) 1920.

destruction of tissue occurs, with great pain and a very fetid odor to the breath. In patients harboring a preponderance of Vincent's spirilla and comparatively few fusiform bacilli, the tissue rarely ulcerates, but is likely to exhibit only the signs of low-grade inflammatory reaction.

In the chronic forms of tonsillar infection, hypertrophy of the tonsil with deepened crypts that invite recurrent attacks or acute exacerbations of tonsillar inflammation is the rule. In the acute forms, the stage of infiltration is followed early by necrosis of the superficial tissues. Ulceration of the submucosa occurs, with a grayish-white pseudomembrane consisting of coagulated serofibrinous exudate from the ulcerating surface, cell detritus, etc. Pressure over the infected areas is quite painful and causes the denuded surfaces to bleed. Hemorrhage is induced even by the most gentle wiping of the exudate from the ulcerating surfaces with cotton or gauze sponges. Healing of the ulcers takes place rapidly after the establishment of an environment unsuited for growth of the organisms. The tonsillar infections run a course of two or three weeks, and healing occurs after exfoliation of the putrid plugs of exudate and necrotic tissues from their crypts, exposing the ulcerating surfaces to aerobic conditions.

Lymphatic involvement accompanies the severe forms, during which the submental, submaxillary and cervical nodes become palpable, painful, and extremely tender, but do not suppurate. Severe secondary lesions are observed in patients whose bodily resistance has been lowered by senility, malnutrition or disease.

The blood picture is that of a very moderate leukocytosis, seldom exceeding 10,000 white cells per cubic millimeter, but with a reduction of the red cells suggestive of secondary anemia. Otitis media has resulted from extension of infection through the eustachian tubes. Invasion of the lungs by direct extension or aspiration occasionally results in pulmonary gangrene or in abscess formation. Brain abscesses have followed the extraction of teeth under local anesthesia in mouths harboring the infection. Vincent's organisms are the active destructive agents in the majority of cases of gangrenous stomatitis, or noma; as well as in the extensive ulcerations occurring in leukemia. In both the latter conditions, Vincent's spirilla invade the tissues far beneath the surface; which may account for the massive tissue destruction in those cases.

During epidemics, the incubation period ranges from twelve to twenty-four hours, although the time is considerably longer in less virulent forms of the disease. After the relatively short incubation period, the onset of symptoms may be either sudden or gradual, being dependent on the virulence of the organisms and the susceptibility of the host. In tonsillar infections, the symptoms develop quite rapidly, consisting of soreness; constant pain in the pharynx, which is aggravated by swallowing; salivation; fever, which is usually under 101 F.; anorexia, and a marked feeling of lassitude and mental depression. The tonsils are swollen and their crypts studded with grayish white spots of coagulated exudate. The infection may be confined entirely to one or both tonsils, but frequently spreads over their surfaces and to the faucial and palatal mucous membranes, simulating diphtheria in its general appearance. In from seven to ten days from its onset, the false membrane is exfoliated, raw granulating surfaces remaining that heal slowly because of the tendency of the pseudomembrane to re-form. Laurens[4] states

4. Laurens, Georges: Oto-Rhino-Laryngology, New York: William Wood & Co., 1919, p. 221.

that the usual course of Vincent's infection is from two to three weeks.

In the gingival infections, the primary sites of inoculation are the interproximal spaces or the crypts under gum opercula. Destruction of mucous membrane is rapid, the edge of the ulcers being sharply defined and of a punched-out, ragged appearance. Bleeding from the submucous vessels is often the first symptom of which many patients are aware, although, early in the disease, the sensation of wedging between the teeth and dryness of the mouth is commonly experienced. Later, the teeth become tender and painful to mastication. In untreated cases, mastication and brushing soon become impossible, as the ulceration extends along the gingival margins of the labial, and occasionally the lingual, surfaces of the teeth until all gingival margins encompassing the teeth in both arches become outlined with a grayish white slough. If the condition is untreated, in patients susceptible to the disease, progressive destruction of the gum septums in the interproximal spaces and deep gingival fissures ensue, the destructive process continuing as a form of chronic pyorrhea. After healing, the neglected and severe gingival cases often leave permanent evidence of their invasion in the form of flattened or depressed interdental spaces and permanently receded gingival margins.

Although the temperature of these patients seldom exceeds 101 F., mild fever is common during the acute stage of the infection or until the false membrane is exfoliated.

A decidedly offensive putrefactive odor to the breath, present from the earliest onset, is so characteristic that many cases can be diagnosed from it alone. The odor is caused by putrefaction and by digestion of the necrotic tissues by the fusiform bacilli.

Patients suffering from leukemia and diabetes are especially prone to Vincent's infection and gingivitis. In these cases, it not uncommonly assumes a progressively necrotic form of gangrenous stomatitis or noma. In fact, all cases of noma give positive cultures of fusospirochetal organisms. In the latter form of the disease, its malignant characteristics are progressive. Large masses of gingival and buccal tissues die and systemic signs of toxemia become increasingly severe, until death of the patient occurs from septicemia. In those patients whose health is otherwise normal, the disease frequently assumes a chronic form.

Vincent's infection is no respecter of persons, and persons in every walk of life have been known to contract it. Those of unsanitary habits of mouth hygiene are most susceptible. Malnutrition, cigaret smoking and chronic alcoholism stand out as especially prominent predisposing conditions. Patrons of boarding houses where sterilization of eating utensils is neglected and dishwashing is performed in a slovenly manner; soldiers in camp or on the firing line, and persons living in huddled and unsanitary surroundings contract the disease far more frequently than do those living on higher social planes.

Recurrences are common, and one attack does not confer immunity, probably because patients can seldom be induced to change their living conditions and dietary and other habits which invited the disease in the first instance. Gingival tissues in which the interproximal gum papillae have been destroyed offer more favorable breeding grounds for the organisms than do normal tissues. Also, many patients discontinue treatment as soon as their mouths feel comfortable instead of continuing until smears from the areas become negative.

Active ulcerations in the mouth and

tonsils are very likely to spread to the buccal, lingual, palatal and faucial mucous membranes. Open wounds are highly susceptible; and, after extraction of teeth, unhealed alveoli are especially prone to have their blood clots destroyed by these organisms, with secondary hemorrhage, painful dry socket and retarded healing. Aspiration of infected material has resulted in the formation of lung abscesses. Extraction of teeth in the presence of acute Vincent's infection has been followed by phlebitis of the pterygoid plexus, meningitis and brain abscess. Cases of balanitis and of vulvovaginitis have also been recorded, proving that all mucous membranes are at times susceptible to the infection.

Some authors assert that the organisms are normal inhabitants of healthy mouths, but this statement is disputed by Appleton[5] and others. Gingival scrapings obtained from the teeth of dental students demonstrate their presence in at least one-half of all examined. Those who have conducted systematic and thorough mouth examinations for large groups of people realize that there are relatively few mouths of adults in which it is impossible to express blood from one or more interproximal spaces under deep pressure, and the majority of these cases yield positive smears of Vincent's organisms. The acute form is characterized by the punched-out or crater-like appearance of the ulcers; while the chronic forms present little visible ulceration, although there exists a chronic hyperemia of the gingival margins. It is therefore likely that the organisms may be harbored as saprophytes in low-grade chronic infections, with symptoms so slight that they pass unobserved by the patients. In severe epidemics, everyone contracting the disease becomes suddenly aware of its presence, because of pain, tenderness, hemorrhage, which occurs either spontaneously or on the slightest irritation, swollen and tender lymph glands, fever, general malaise and prostration severe enough to unfit the patient for his usual daily routine.

The diagnosis of Vincent's infection is based upon the clinical picture of a distinctly outlined ulceromembranous inflammation, the symptoms of constant pain, salivation, insomnia, painful mastication and deglutition, the characteristic odor of the breath, moderate fever, absence of leukocytosis, with the possible exception of a slight increase in mononuclear leukocytes (basophylic), and the finding microscopically of an abundance of both fusiform bacilli and spirochetes of Vincent.

Because of the pseudomembrane, it is sometimes difficult, clinically, to differentiate Vincent's infection from diphtheria; and in all severe cases involving the fauces, cultures should be made and examined for Klebs-Loeffler bacilli.

Follicular tonsillitis caused by other bacteria produces massive swelling of the tonsils without the formation of a false membrane. Smears from the area readily establish a diagnosis.

The secondary lesions of syphilis have been confused with Vincent's infection. Syphilitic ulcerations are usually less painful, yet more destructive and prone to extend to the buccal and palatal areas, than is Vincent's infection. It is not uncommon to find Vincent's gingivitis and stomatitis occurring in syphilitic patients, and the Wassermann reaction as well as mouth smears should be made in all suspected cases, as the diseases frequently occur simultaneously.

Aphthous stomatitis is differentiated by its occurrence in the vestibule and floor of the mouth at some distance from the gingival margins and the presence of

5. Appleton, J. L. T.: Bacterial Infection, Philadelphia: Lea & Febiger, 1925.

round or oval ulcers that rarely exceed 3 or 4 mm. in diameter.

Pyorrhea alveolaris always harbors a large variety of bacteria, among which fusiform bacilli and spirochetes are usually present. As previously stated, the mere presence of Vincent's organisms in moderate numbers along with other mouth flora does not confirm the diagnosis of Vincent's disease; but if clinical symptoms of tenderness and bleeding of the gum are accompanied by a preponderance of Vincent's over other bacteria, treatment should include that for Vincent's infection in conjunction with the routine treatment for pyorrhea.

No hard and fast rules can be made regarding the prognosis, which depends entirely on the virulence of the invading organisms, the natural resistance of the patient, and the thoroughness with which treatment is administered. In patients enjoying good general health and having otherwise normal gingivae and tonsils, and who observe good methods of oral hygiene, the prognosis is always favorable, and, with proper treatment, the duration of the acute symptoms should subside in from one to two weeks. In healthy patients who persist in excessive smoking of cigarets, the acute attacks may be overcome in two or three weeks, but there remains a great tendency to recurrence. Senile patients and those who have not fully recovered from acute fevers and sufferers from leukemia, pernicious anemia and diabetes are very prone to develop severe and malignant forms.

As a prophylactic measure, all drinking cups, dishes and other eating utensils should be thoroughly scalded after use. Such unhygienic habits as holding lead pencils in the mouth or using another's pipe should be avoided; as should kissing or other personal contact with patients having active symptoms of the disease. Toothbrushes should be disinfected in sodium perborate solutions.

The smoking of cigarets is a great predisposing factor in the disease, and indulgence in them should be forbidden during treatment. Whenever possible, the use of the toothbrush should be encouraged, but, in the acute stages, gentle swabbing with cotton or gauze may be substituted.

In selecting therapeutic aids, it should be remembered that no other infectious disease has had suggested so great an array of treatments. Lichtenberg, Werner and Lueck[6] were able to report many cures without treatment. Other authors prescribe no antiseptics at all, depending entirely on thorough brushing of the teeth and mechanical cleansing of the ulcerating surfaces. Others regard the disease as an avitaminosis and suggest that a quart of orange juice with the juice of three lemons be added to the daily diet. There can be no doubt that the foregoing treatments have cured many patients, but, in my experience, the treatment of Vincent's infection is most uniformly effective when topical applications of antiseptics and frequent use of oxidizing mouth washes play a prominent rôle.

As a rational therapeutic measure, based upon a knowledge of the anaerobic character of the infective organisms, these antiseptics that destroy bacteria by oxidation seem best adapted to combat the infection. Of the oxidizing agents, solution of hydrogen dioxide U.S.P. diluted with equal parts of water has proved very effective. Freshly prepared sodium perborate solutions produce a similar oxidizing effect to that of hydrogen dioxide and possess the additional

6. Lichtenberg, H. H.; Werner, Marie, and Lueck, Esther: Pathogenicity of Fusiform Bacillus and Spirillum of Plaut-Vincent, J.A.M.A., 100:707 (March 11) 1933.

advantage of being alkaline instead of acid in reaction. These oxidizing agents disintegrate the pseudomembrane overlying ulcerating areas, deodorize putrefying tissue and give a serious setback to anaerobic bacteria.

Arsenical preparations in the form of Fowler's solution (solution of potassium arsenite) and arsphenamine are well known spirocheticides, and the latter has been used intravenously on the assumption that it destroys the spirochetes here as in syphilis; but its results have been disappointing. Aison[7] recommends topical applications of arsphenamine in 3 to 6 per cent solutions made in glycerine. Fowler's solution has proved helpful when applied topically to the lesions. It is interesting to note that the presence of Vincent's organisms does not influence the Wassermann reaction.

Before the causative organisms were identified, the infection was treated empirically by topical applications of silver nitrate, zinc sulphate, tincture of iodine, potassium permanganate, trichloracetic acid, emetine, boric acid, chlorine solutions, etc., reinforced with potassium permanganate mouth washes and gargles. Topical application of these agents has now been largely supplanted by the use of chromic acid in from 5 to 10 per cent solution.

An effective form of treatment consists in first removing the gray exudate by gently wiping the infected areas with gauze sponges or by forceful irrigation or spraying with a dilute hydrogen dioxide solution. The ulcers are next dried with warm air and the topical application of a 7 per cent aqueous solution of chromic acid is made to all surfaces. The home use of dilute hydrogen dioxide solution or a solution of sodium perborate every two hours for two days is prescribed, and inquiry is made as to the patient's diet. When inquiry elicits the fact that the intake of antiscorbutic vitamins is deficient, the juice of two oranges or lemons and at least one fresh vegetable daily is prescribed. When the patient next returns, the infected areas are again cleansed, the chromic acid solution is again applied and the patient is directed to use the oxidizing mouth wash every three hours for three days; after which the favorable cases will have shed most of the false membrane and the denuded tissue is found to be making an effort toward healing. Denuded surfaces are again cleansed as before and painted with chromic acid solution, and the patient is directed to use the mouth wash after each meal and before retiring, for one week. At the next visit, all calculus and stains are removed from the teeth and irritating margins of fillings and crowns rendered smooth. The patient is again directed to use the mouth wash after each meal and to return in one week; when careful scrutiny is made for gingival areas that persist in bleeding under pressure. If any are found, exploration will invariably reveal bits of subgingival calculus or the presence of irritating dental protheses which need correction. It is very important that the patient be made to understand that the causative organisms are harbored in the interproximal spaces and tonsillar crypts, and a generous mouthful of the antiseptic solution should be forced to and fro through all interproximal spaces for at least three minutes each time it is used and finally as a gargle before it is expectorated.

The dental locations most persistent and unyielding to treatment are those in contact with rough deposits of calculus, irritating edges of fillings, carious teeth and the tissues about crowns and bridges; where complete eradication of the in-

7. Aison, Emil: Vincent's Stomatitis, D. Cosmos, 63:118 (Feb.) 1921.

fection may occasionally require the removal of ill-fitting crowns and unhygienic bridgework. Treatment should be continued until smears from the gingival crevices fail to disclose the presence of fusiform bacilli and the spirochetes of Vincent; and it is only when negative smears are obtained that the disease may be regarded as cured.

In carrying out the foregoing treatment, the end-results will depend on the thoroughness with which the patient carries out the home care of the mouth. Thorough brushing methods must be taught and practiced as soon as the decreasing sensitiveness of the gums will permit. After all, the particular medicinal agents employed are probably of less importance than is the thoroughness of their application, and the patient's ability to keep his mouth clean and to cooperate by observing the general health and dietary measures necessary to maintain his tissues in a high state of health. Coolidge[8] says,

> Regardless of the treatment used to control the acute stage of infection, a long period of thorough mouth hygiene must be maintained to prevent a recurrence of the disease. The patient should report for examination at frequent and regular intervals for a few months. The evidence of a cure is a healthy and clean mouth free from pockets and gingivitis.

The treatment of chronic proliferative forms which eventuate in hypertrophy of the gingival tissues often requires excision of the hypertrophic tissues, which is then followed by the usual local treatment for the purpose of eradicating the organisms.

Mild forms of the disease require no systemic treatment, while the severer types call for increased elimination of toxins via the intestinal tract. Here, the saline cathartics in moderate dosage are most effective.

Pain in the acute infections can be minimized by the internal administration of amidopyrine or acetphenetidin in 5 grain doses every three hours. The insomnia is best combated with barbiturates either alone or in combination with amidopyrine. Five grains of soluble barbital, or one-half grain of phenobarbital at bedtime will usually induce sleep.*

SUMMARY

Fusospirillary organisms are present in the majority of human mouths and, like the organisms of the common cold, may cause no discomfort.

The diagnosis of Vincent's infection or gingivitis is based on the presence of the clinical symptoms of the disease and the finding of large numbers of the organisms in smears obtained from the lesions.

Lowered vital resistance of the tissues is a prerequisite to the establishment of the disease. Common predisposing conditions are avitaminosis, malnutrition, blood dyscrasias and disturbed metabolism. Cigaret smoking greatly increases susceptibility, and, if persisted in, greatly retards recovery.

In favorable cases, oral and general hygienic measures alone have sufficed to restore the tissues to health and eradicate the organisms.

Treatment must be continued for several weeks after the subsidence of clinical symptoms as a prophylaxis against recurrent attacks.

8. Coolidge, E. D.: Illinois D. J., 2:562, 1933.

*The drugs mentioned are described in "Accepted Dental Remedies."

ANKYLOSIS OF THE TEMPOROMAXILLARY JOINT*

By FULTON RISDON, M.B., D.D.S., F.R.C.S., Toronto, Canada

IT is my purpose before entering into a discussion of diseases of the temporomaxillary joint to review briefly the anatomy of this area. As you will recall, the ascending ramus has two processes, the condyloid and the coronoid, and between these two is the sigmoid notch. In the recent state, the condyloid process is covered with cartilage and the coronoid process is free for attachment of the muscles. On the external surface of the ascending ramus, the masseter, temporal, capsular and external lateral ligaments are attached. On the internal surface, there are attached, low down, the internal pterygoid muscle and, high up, at the surgical neck, the external pterygoid. Anteriorly, in the region of the coronoid process, is attached the temporal muscle. The condyloid process with its overlying cartilage fits into the glenoid fossa of the temporal bone, which is bounded anteriorly by the eminentia articularis and posteriorly by the vaginal and auditory processes. It is necessary to note at this time that the roof of the glenoid fossa forms the floor of the middle fossa of the skull and that the intervening bone is quite thin at times. The base of the zygoma, which forms the outer surface of the glenoid fossa, has three roots, the anterior of which is the eminentia articularis; the middle, the vaginal and auditory processes, the posterior blending superiorly with the mastoid process. If the vaginal and auditory processes are thin or are absent, the external condyle has a tendency to obliterate, in the recent state, the external auditory meatus, and this point is emphasized because of the likelihood of infection from the middle ear.

The ligaments which limit this joint are the external lateral, capsular and the so-called interarticular fibrocartilage. The structures overlying the bony structure are, first, the external skin, the subcutaneous tissue, the external lateral ligament, the capsular ligament and the interarticular fibrocartilage. The important structures to be guarded are the frontal and orbital branches of the facial nerve, the temporal artery and its branches, the temporal vein and, lower down, the auricular temporal nerve. Internally from the condyle and winding forward is the internal maxillary artery, which is occasionally injured when the head of the condyle is removed. When the temporal artery and vein and branches are torn or cut unintentionally, a most troublesome hemorrhage occasionally results; but this generally can be avoided.

If the usual textbook incision (horseshoe-shaped), starting anteriorly from the ear and curving forward and above and over the zygoma, is used, there is a danger of severing the frontal and orbital branches of the facial nerve which gives movement to the occipitofrontalis muscle; and, for that reason, I am suggesting a vertical incision only, and one not to be carried forward over the zygoma as

*Read at the Seventieth Midwinter Clinic of the Chicago Dental Society.

usually described. If the incision is extended below the level of the external auditory meatus, the main trunk of the facial nerve will be divided.

It is necessary to classify the diseases of the temporal maxillary joint under three headings. They are usually classified under the name trismus and for convenience are spoken of as articular, extra-articular and articular extra-articular. In this discussion, we are more concerned with the articular type of injury to this joint, and this again may be divided into two headings, fibrous and bony. Before continuing the subject of bony ankylosis, I shall briefly outline the extra-articular and the articular extra-articular conditions. These are limited to injuries of the coronoid process and myositis. The coronoid process may be displaced inward and attached to the base of the skull, or outward and attached to the inner surface of the zygoma. Myositis may occur from many conditions, such as the presence of a broken needle in the internal pterygoid muscle, abscess due to osteomyelitis or dental infection, syphilis due to gumma, the presence of an infected impacted third molar tooth, or any condition which interferes with the movement of the muscles of mastication and has a tendency to produce fibrosis in healing.

The treatment of these various cases as a rule means removal of the cause; but if the muscle has gone into a state of fibrosis, it is necessary, as we have seen in a number of cases, to lengthen the muscle in the direction of its fibers by the use of a skin-graft. For instance, if the internal pterygoid muscle has been largely lost and replaced by fibrous tissue, by planting a skin-graft at right angles to the fibers completely through the scar tissue and allowing it to heal, movement may be restored.

In the articular extra-articular diseases, the foregoing description is complicated by some disease of the joint itself, and this condition may best be described when treatment for the articular diseases, such as bony ankylosis, is outlined. If the limitation in the joint is entirely due to fibrous tissue, it may be possible, by more or less continuous pressure applied between the upper and lower jaw, to so stretch this scar tissue that good movement may be obtained. In my practice, considerable time is given to the treatment of fibrous arthritis, if the fibrous attachment has not become too firm. In such cases, when the fibrous union allows very little excursion of the jaw, resection gives the best result.

ETIOLOGY

Bony ankylosis of the joint has its inception as an arthritis, but is generally caused by infection or trauma, but one is surprised at the few cases in which trauma results in bony ankylosis, such as when the head of the condyle has been fractured, and no operation attempted for its removal. That is a point worth considering. I am sure many have seen fractures of the lower jaw through the surgical neck of the condyle, involving the joint, where no marked limitation resulted.

Under infection, the following conditions are to be considered, pyemia following septicemia, otitis media, osteomyelitis, periosteitis and, in some cases, gonorrhea, rheumatism and metastatic malignancy. It is rather interesting to note in the history of this condition that Humphrey reports resection of the head of the condyle in 1854, Grube in 1863 and Whitehead in 1874. Many surgeons have modified this operation since Helferich interposed muscle between the head and the glenoid fossa. Mikulicz interposed masseter muscle, and Murphy used fascia from

the temporal muscle. Roser introduced a gold plate. Payr suggested magnesium; Hoffmann used free periosteum, and Rochet and Poisson resected the ascending ramus. So much for the early history of this operation.

The sexes are about equally affected. Orlow found sixty-eight patients, 80 per cent between 1 and 10 years, 15 per cent between 11 and 20 years and 5 per cent between 20 and 30 years. In this group of cases, he gives trauma as the causative agent in 29.4 per cent; otitis media in about 22 per cent; osteomyelitis from neighboring bones, 12.6 per cent; and rheumatic, gonorrheal and other inflammations of the mandibular joint, 10.5 per cent. Blair reports about 5 per cent of his large series of cases as due to trauma. In my series of cases, infection has largely been the causative agent, but three of my cases were congenital, the patients being born without any movement in the region of the condyle.

METHOD OF EXAMINATION

Diagnosis, as a rule, is not difficult, but certain cases present some confusion, and there are a number of reasons for this. First, the history may be vague, and if the case is due to trauma, the patient or family cannot state which side the disability is on, and as the teeth cannot be separated, the one difficulty may be to ascertain whether one or both joints are involved. Another point is that there may be an involvement of only the interarticular fibrocartilage and not the bony as the joint has not been destroyed. That means that it would be unwise to attempt resection of the head of the condyle, and treatment in this case would be removal of the interarticular fibrocartilage. I saw one case of this type. Further, if there is some interference with the movement in the region of the coronoid process, and by that I mean coronoid adhesion either bony or fibrous to the zygoma or base of the cranium in that position, roentgen examination would help to clarify the diagnosis. It would be unnecessary to resect the head of the condyle as the joint would not be involved, and a much better result would be obtained if the coronoid only were resected and the condyle not interfered with in any way.

When the patient reports the inability to separate the teeth, careful search should be made for the cause as that has considerable to do with the treatment of choice. If, for instance, it is due to otitis media, it is likely that the head of the condyle involving the interarticular fibrocartilage has been destroyed, but if it is due to osteomyelitis, probably the condyle and the coronoid in one bony mass have become attached to the base of the skull. If, on examination, there is found to be some movement, and, with gentle pressure of the finger between the incisor teeth, it may be possible gradually to force the mouth open with pressure, in that variety of case, usually I find that it will open so far and no amount of pressure has any beneficial influence. This case may be considered to be in the bony classification as far as treatment is concerned. The external auditory canals should be inspected, the amount of atrophy of the face noted, photographs taken and, what will help most in arriving at a conclusion, good stereoscopic roentgenograms should be taken, as one is frequently at a loss to know which joint is ankylosed. As a routine, I would suggest taking the posterior-anterior stereoscopic roentgenogram of the skull to show the joint, and a special mastoid technic stereoscopic film of the right side to be used as a control for the opposite side. These special roentgenograms are, I find, taken only by the technician who is interested in this type of work, and

the surgeon should not be satisfied unless the joint on both sides is clearly outlined, in spite of the difficulties the technician may have.

The operative treatment should be considered under two headings, the high operation and the low operation; and here may I suggest that the high operation has, in the minds of a number of surgeons, lost cast, but I am not so sure that they are 100 per cent right. In the high operation, I am using an incision which is perpendicular, extending from the lower border of the external meatus of the ear, upward as high as one wishes, probably about an inch and a half. If the surgeon will give a little time to the dissection at this point, he will, as a rule, be able to save the temporal artery, but generally the transverse facial must be divided, and, immediately beneath the deep fascia, the external and capsular ligaments are to be found. In some cases, it is difficult to identify these structures owing to the old inflammatory reaction. For retraction, I use a double mastoid retractor, and I usually can expose this point moderately well to allow for removal of the head of the coronoid process; but frequently it is necessary to lower the zygoma in the region of the eminentia articularis to gain better access to this area. There are two points that one must keep in mind: first, that the posterior portion of the joint, namely, the vaginal and auditory processes, may be thin, and that the roof of the glenoid fossa may also be thin. That, of course, would, if undue force is used, mean an opening into the middle fossa of the cranium; and, further, if one lowers the incision to make more room below the level of the floor of the external auditory meatus, the main branch of the facial nerve which supplies movement to the entire face may be permanently injured. With sharp osteotomes, a section of bone which the surgeon recognizes as the surgical neck of the condyle, one-half inch wide or more, should be removed. That may sound very easy, but if we consider that this fossa, including the head of the condyle, is nearly one and a half inches deep when the soft tissue is considered, and that it may be necessary to carry the incision forward to obtain removal of the coronoid process as well, in a short and poorly formed ascending ramus, the surgeon will realize that it is a procedure not entirely free of dangers to the patient and presenting some difficulties.

I am well aware that, in many cases, this type of operation is to be preferred, but, in my hands, I believe that the periosteum or small bony particles have been left to again cause a limitation of movement due to the reformation of bone. For that reason, I have been using an operation which may be more or less original; that is, making an incision low down over the angle of the mandible, removing enough skin and subcutaneous tissue here to obtain access to the inferior attachment of the masseter muscle so that it may be divided, and reflecting the upper part of the muscle to a higher position, almost to the bony deformity causing the ankylosis. Then, under direct vision, we remove one-half inch of the ascending ramus, leaving the deformed condyle and coronoid in position. In this way, we produce a pseudarthrosis high up, and we avoid leaving bony particles, which are difficult to remove, in such a deep cavity as outlined in the higher operation. On completion of this operation, we sew the internal pterygoid through this opening in the ascending ramus to the masseter, thereby interposing a section of muscle between the two divided ends of the ascending ramus. I may say that I have used in the higher operation fascia from the temporal muscle

as interposing material, but have found it insufficient. Later, I used Cargile membrane, but, in two of these cases, the Cargile membrane sloughed and was extruded through the external auditory meatus. I do not believe that the interposition of tissue in that position is of much value in these operations, but, in the method that I advocate, the muscle is not divided, its blood supply remains in its original condition and, I believe, acts in such a way as to prevent the reattachment of the two fragments of the ascending ramus. I may state that in only two cases have I used the low incision as described, low down over the ascending ramus, but my results have been more pleasing.

CONCLUSION

If the surgeon is obtaining good results from the high operation, I would not suggest that the other one be used. I have seen a number of operators obtain excellent results from the high operation, but, in these cases, I believe that the involvement was confined quite largely to the glenoid fossa and the head of the condyle. In the older cases, it has been my experience to find one mass of bone uniting the ascending ramus to the base of the skull, and I believe that the lower approach will give a greater percentage of satisfactory results with much less surgical risk, and it is an operation which can be performed more expeditiously.

901 Medical Arts Building.

LOCAL ANESTHESIA*

By HOWARD C. MILLER, D.D.S., F.A.C.D., Chicago, Ill.

IN any operative procedure in the field of oral surgery and exodontia, the selection of the anesthetic is an extremely important step. As a consequence, it is not unusual to find the merits of both local and general anesthesia discussed pro and con in the form of a symposium in such a program as this. The intention of the program committee today is that these two papers be presented with no attempt to show a decided preference for one over the other, but to point out the outstanding advantages of each. All too frequently, advocates of one type of anesthesia discuss the subject in the form of local anesthesia versus gas-oxygen anesthesia; but because of the value of each to this branch of dental science, the subject does not in fact lend itself to debate.

My colleague, Dr. Stowell, who is so eminently qualified to present the subject of nitrous oxid-oxygen anesthesia, will bring out many points in its favor in his portion of this symposium, and I know that he will be just as broad in his attitude toward local anesthesia. There is no one anesthetic best suited to all cases, but there is generally one best suited to the individual operation. The successful operator selects the anesthetic best adapted to the case—the one by use of which the patient will receive the maximum benefit. His decision, based entirely upon his own training and clinical experience, should be guided by the physical condition and temperament of the patient, the type of operation to be performed and his personal choice. The patient has a right to

*Read at the Seventieth Midwinter Clinic of the Chicago Dental Society, Feb. 27, 1934.

expect those operating in this field to be qualified to administer either type of anesthetic, as indicated.

The patient who comes to the dentist for surgical service is entitled to, and should receive, the following considerations: (1) accurate diagnosis; (2) selection of the proper anesthetic; (3) correct operative procedure, and (4) whatever postoperative care may be necessary.

It must be remembered that a correct diagnosis is the basis of all successful treatment, and the diagnosis must be complete before the proper anesthetic can be selected or operative procedure can be undertaken. Correct diagnosis embodies a consideration of the roentgenographic findings, and their correlation with clinical signs and symptoms, corroborated by other tests such as inspection, palpation, percussion, response to thermal change, electric vitality tests, bacteriologic examination and all other aids that are at the command of the dentist of today. Many times, cooperation with the patient's physician is necessary in order that his findings and his interpretation of general conditions and laboratory reports may be added to those of the oral diagnostician.

After a careful consideration of all diagnostic findings, the anesthetic best adapted to the case should be selected. If the final decision is for local or block anesthesia, it must be remembered that its successful administration calls for scrupulous asepsis, proper anesthetic solutions, a thorough knowledge of the anatomy of the parts involved and an exact technic.

In the diagnostic consideration of a case, it must be remembered that there are certain local and general conditions in which great care must be exercised. Sometimes, indeed, the use of a local anesthetic is absolutely contra-indicated; in some cases, it may be used only with the utmost caution. In acute types of dental infection, even in the early stages, the extent of tissue involvement and the virulence of the responsible organism are unknown factors. In cases of acute Vincent's infection, there is great danger of causing widespread and serious infection. This is also true in the presence of any form of acute ulcerative gingivitis or severe infections about unerupted or impacted third molars. A local anesthetic should never be employed in any operative field in which the blocking of the nerve supply requires the insertion of the needle into an inflamed or infected area.

There are general constitutional conditions in which, by careful management, local anesthesia may be used. In a patient with a definite heart impairment, the hazard is always great and there is no absolutely safe anesthetic. Should local anesthesia be employed, the solution should contain a minimum amount of epinephrin, it should have a neutral or alkaline p_H, and it should be injected slowly and at body temperature with the patient in the recumbent or semirecumbent position. The same precautions are necessary in thyroid disturbance, hypertension, arteriosclerosis, acute or chronic nephritis, diabetes, anemia, tuberculosis or epilepsy, or in any condition in which the patient's vitality is low. No matter what type of anesthetic is used in such a case, the patient must have particularly careful supervision. Operative procedures should be restricted to a small area, which can be anesthetized by a minimum number of injections and the smallest amount of solution possible.

The confidence of the patient should be gained beforehand in order that his excitement and fear may be allayed. He should be advised of the proposed procedure and of the sensations and after-effects to be expected. A few moments spent in establishing such a relation may serve to add to the peace of mind of the

patient as well as that of the operator. In an extremely nervous patient, in whom extensive operative procedure may cause shock, some form of preoperative medication is indicated. In the hospitals, of course, this is customary, but, in office practice, there has been some hesitancy in using preoperative medication, especially in the form that is used routinely in hospital practice. During the past few years, considerable study has been made of the use of barbiturates as preoperative medicaments for either local or general anesthesia. Several valuable contributions to this subject have been made in both medical and dental literature. It has been demonstrated that, in addition to quieting the nervous, apprehensive patient, the use of some form of barbiturate as a preliminary measure increases the safety margin of the local anesthetic. Patients who have shown definitely unfavorable reactions to the use of procain-epinephrin solutions have shown no such symptoms after the use of 1.5 grains of pentobarbital sodium thirty minutes to one hour before operation. In more difficult cases, the administration of 1.5 grains the night previous, repeated thirty minutes before operation, has proved very satisfactory.

ASEPSIS

Scrupulous asepsis must be adhered to throughout the entire procedure. Absolute asepsis in the mouth is, of course, not possible, but at least an aseptic technic can be followed by which the area of injection is protected from contamination. Instruments, syringes and needles should be sterilized by autoclaving or boiling, and the utmost care should be taken in preparation of the anesthetic solution. The mucous membrane of the region to be injected should be dried, after which some germicidal agent is applied to render the part as nearly aseptic as possible. A sterile needle should be used for each subsequent injection. Never use the same needle for additional deep block injections in various locations.

With the increasing popularity of prepared solutions sold to the profession in glass containers which are manufactured to fit syringes of various designs, there has been a tendency to neglect the careful preparation of the syringe and glass container before making the injection. When this form of solution is used, the syringes should be autoclaved or boiled and the glass container should be placed in a germicidal solution for sufficient time to assure its asepsis. The anesthetic solution should be warmed to approximately body temperature. In many cases, prophylactic treatment is indicated before surgical interference is attempted. A neglected, inflamed and unhealthy mouth should be brought to as healthy a condition as possible before a local anesthetic is used. Every attempt should be made to maintain a definite chain of asepsis and to prevent the introduction of bacteria; which is of vast importance to any surgical technic.

ANESTHETIC SOLUTIONS

Much research and experimental work has been done in recent years in an effort to produce a perfect anesthetic solution, and, no doubt, whatever future advancement there may be in this branch of dental science will be toward perfection of the solutions. In view of the fact that our technical procedures are based entirely upon anatomic relations in the human skull, it is obvious that there cannot be much variation in technic. Too little attention has been paid to anesthetic solutions. In the past, the dentist has accepted without question the statements of the manufacturer that his product contains procain and epinephrin in amounts adapted to dental use, without knowing the actual amount of the epi-

nephrin content, and without knowing whether the product complies with other requirements of an ideal anesthetic solution.

What are the requirements of an ideal anesthetic solution? It should be sterile; it should be capable of producing profound anesthesia in as short a period as possible, maintaining it for sufficient time to permit the usual dental operative procedures; it should contain a vasoconstricting agent that does not produce unfavorable symptoms or toxic reaction when properly injected; it should not cause local tissue irritation and should conform to the physiologic laws and functions of the living cells.

Experience has shown that a procain hydrochloride-epinephrin solution, which has been accepted as the ideal anesthetic solution since novocain (procain) was compounded by Einhorn in 1905, does not entirely meet all of these requirements. Much has been written on the reaction of tissue to the hypotonic, hypertonic and isotonic solutions, and for years our attention has been called to the importance of an isotonic solution and the necessity of using salts in the anesthetic vehicle, such as the calcium, sodium and potassium chlorides contained in a prepared Ringer's solution. Only during the past few years has it been pointed out that this solution has a hydrogen-ion concentration (p_H) value of approximately 4.4, while the normal p_H of the living tissues is 7.4. Investigation of the various anesthetic solutions of procain hydrochloride and epinephrin, prepared either from tablets or in nearly all the manufactured stock solutions, reveals that the p_H is considerably below that which is an accepted normal of the blood and tissue cells, unless the solution has been buffered by the use of a salt whose presence tends to hold the p_H constant in spite of the addition of acid or alkali.

It has not been proved conclusively that the anesthetic solution must have a p_H exactly equal to that of the body tissues and the blood, but, according to Dr. Freeman, who has made extensive studies of alkaline anesthetic solutions, it should not vary from that more than one p_H value in either direction. The limits of efficiency appear to be reached on the alkaline side (8.4 p_H), and it is reasonable to assume that a solution with a p_H as low as 6.4 is within reasonable limits.

A vasoconstrictor in some form is necessary in the use of a local anesthetic, and, in the majority of solutions now used, is present in the form of epinephrin in varying amounts. This agent is necessary to constrict the blood vessels and retard the absorption of the local anesthetic, thus localizing the action of the latter and prolonging anesthesia.

It is a well-known fact that the disturbing features of local anesthesia, such as alarming and unpleasant reactions, occur most frequently in susceptible patients through the use of solutions containing epinephrin, although the exact cause of the reactions is unknown. Therefore, it is necessary to be certain of the amount of epinephrin contained in every solution. The epinephrin content must be regulated in accordance with the physical condition and the age of the patient, the extent of the area to be injected and the manner and rapidity of injection. Patients who suffer from some pathologic condition, such as cardiovascular disease, are more susceptible than are healthy persons, and here particular care must be exercised in the amount injected.

Procain tablets are available with an epinephrin content, in addition to the one-third grain (0.02 gm.) of procain, ranging from the minimum of one thirty-two-hundredth grain (0.00002 gm.) of epinephrin to the larger amount of one sixteen-hundredth grain (0.00004 gm.),

in which one tablet to 1 c.c. of the anesthetic vehicle will produce a 2 per cent procain solution, and, in the minimum epinephrin content, a one fifty-thousandth solution of epinephrin and, in the larger amount, a one twenty-five-thousandth solution.

Stock anesthetic solutions are available with similar percentages of procain and epinephrin, which may be purchased in ampul or carpul form. It must be remembered that epinephrin is not stable unless some preservative is used, such as phenol or the sulphites. Therefore, these reagents are important in the manufacture of the prepared stock solutions, and yet no mention of their presence is made in the advertisements of such solutions.

The dental profession can secure authentic and valuable information as to the actual content of the various anesthetic solutions if they will avail themselves of the data compiled by the Council on Dental Therapeutics of the American Dental Association. It is no longer necessary to take for granted the statements and claims of the manufacturers of such products. Anesthetic solutions are important: they must receive the same consideration as technical procedures. Investigate the solutions that you are using. Study their composition as well as the clinical results obtained by their use. It is hoped that, before long, a perfect anesthetic solution will be found.

ANATOMY

A thorough knowledge of the anatomy of the parts involved is essential to the successful use of local anesthesia. Many operators attempt to make deep block injections in a mechanical way, following a technical procedure learned through lectures or from articles dealing entirely with technical phases. The operator should be able to visualize the structures through which the needle must pass, the bony surface and the nervous tissue at the point of injection. When this knowledge is complete, local anesthesia ceases to be a mechanical procedure and becomes a definite surgical technic based entirely upon anatomic landmarks.

TECHNIC

An exact technic, based upon the knowledge of a simple, safe and efficient procedure, is essential to the successful use of a local anesthetic. To attempt to advance any particular claims as to the advantages of one technic over another is not the object of this presentation. Present-day technic is based upon the early work of Braun and Fischer, although other authorities during recent years have offered variations and additions to some of the earlier accepted procedures.

Regardless of the technic followed in anesthetizing various branches of the fifth cranial nerve, it is an established fact that the solution should be deposited either at the entrance or at the exit of the nerve trunk from its bony canal, or in the soft tissues along the mucobuccal fold of the teeth to be anesthetized. Clinical experience has proved beyond doubt that slow deposition of a solution in these various locations, with only sufficient pressure to discharge the solution, will cause much less tissue irritation and less primary pain, and will give a far more satisfactory result than if the needle is inserted into the dense surrounding gum tissue and the solution is deposited under considerable pressure. It is necessary that the solution be at or near body temperature at the time of injection, and, in addition, that it have all other possible features of an ideal anesthetic solution.

There are many designs of syringes available, and it makes little difference which type is used as long as it is not too cumbersome and is of such size and shape as to permit ease of manipulation. The

length and gage of the needle should be checked carefully. Should the needle break during the procedure, this may be a very important consideration. If steel needles are used, they should be changed frequently in order to assure a sharp needle, and to avoid breakage at a point that has become rusted. If iridioplatinum needles are used, do not depend alone on flaming the needle for sterilization, as this does not sterilize the hub. Some operators prefer nickel needles, which must receive the same care and attention as steel needles. The needle must be sharp and of sufficient length to permit a portion to remain out of the tissue. Never insert a needle into the tissue up to the hub, for should the needle break (and it usually breaks at the hub), it is difficult to remove it; whereas, should a portion of the needle remain out of the tissue, it is easy to grasp it with artery forceps or pliers.

Should such an accident occur, and a portion of the needle disappear within the tissues, removal should not be attempted except by one who has had clinical experience in such procedure. There is a definite technic for such an operation, based primarily on the accurate localization of the fragment by roentgenograms and the determination of its relation to a guide needle and surrounding osseous structures.

The patient should be in the recumbent or semirecumbent position when the injection is made. It is far better to place him in this position first and forestall any disturbing reaction than to tip back the dental chair after such reaction has occurred. When the operator has accustomed himself to working with the patient in this position, he finds it much easier for himself as well as for the patient.

In making an injection, the syringe should be held in the hand with a pen grasp. Never plunge the needle into the tissue by holding the syringe by the crossbar, as the sense of touch, which is so accurate in the finger tips, is appreciably diminished. Among the preferred injection sites for the maxilla is the posterior-superior dental (tuberosity), for the upper second and third molars, with an additional deposit of solution along the mucobuccal fold over the first molar when this tooth is to be included. If the operation is for removal of these teeth, it is necessary to block the anterior palatine nerve at the posterior palatine foramen. All other remaining upper teeth are blocked by depositing the solution along the mucobuccal fold above the teeth to be included in the operative procedure. If the upper anterior teeth from cuspid to cuspid are to be blocked for extraction, it is necessary to block the nasopalatine nerve at the nasopalatine foramen. The anterior superior dental (infra-orbital) injection is employed for anterior teeth with large cysts, for impacted cuspids or for teeth that require more extensive operation. Blocking of the second division of the fifth cranial nerve in the sphenomaxillary fossa is indicated in cases of maxillary sinus operation, or in any surgical procedure in the maxilla in which a considerable area is involved.

Among the injections of choice for the mandible is the inferior dental lingual injection, the long buccal usually being necessary for the removal of the lower molar teeth, in conjuction with this injection. The mental injection may be used in thin-boned persons and in younger persons for operation on the bicuspids and cuspids, the incisive injection being most desirable for the lower anterior teeth. If operations include the removal of teeth involving areas of the mental and incisive regions, it is necessary to block the lingual nerve also.

The importance of diagnosis, scrupulous asepsis, proper anesthetic solutions, knowledge of the anatomy of the field of operation and an exact technic has been reiterated for many years. These are the fundamental principles of the use of local anesthesia in oral surgery. All we can add from time to time are the newer refinements which are brought out by clinical experience. Most of us are familiar through experience with the tremendous advance made in this science during the past twenty-five years. For the advance of the next quarter century, many men here today will be responsible, and I have no doubt that they will be as important in the history of dentistry.

GENERAL ANESTHESIA*

By C. F. B. STOWELL, D.D.S., Chicago, Ill.

THE chief purpose of this presentation is a clearer conception as to what takes place in the human body during narcosis. The findings are based upon considerable reading, study, thought and years of clinical or, more correctly, chairside experience. To present a matter of such importance without a certain amount of seemingly extraneous asides is undesirable, especially if light is thereby thrown upon different parts of the canvas.

"Coming events cast their shadows before." For fifty years and more before 1850, chemistry, the producer of anesthetics, was being born. It was to take the place of the old pseudoscience, alchemy, which was shrouded in myths and mystery and whose main objective was the transformation of baser metals into gold. This part of history is interesting, but it is somewhat irrelevant. Suffice it to say that the early chemists freed such gases as oxygen and nitrous oxide from compounds. This is elementary chemistry today; then, it was a Lindbergh achievement, without the acclaim. Itinerant showmen entertained my grandfather and his neighbors by making nitrous oxide and allowing those in the audiences to inhale it. A dentist was in one of those audiences, Horace Wells. He was observant. He made a deduction and, all honor to him, he didn't try it on some one else. He tried it on himself, and anesthesia became human knowledge. I like that epic in dental history. In physical good, it is indeed comparable to the spiritual good in the twenty-third Psalm.

The anticlimax of Wells' career came when he made a fiasco of a demonstration before some unsympathetic physicians. He took his failure to heart and died a suicide. The truth he discovered lived.

Progress in surgery, beyond peradventure of a doubt, would have been impeded, if not checked, had it not been for this and other discoveries in anesthesia in the 1840's. Anesthesia has made the surgery of today possible. Indeed, it is now impossible to contemplate the one without the other. The surgeon with his staff and the anesthetist with his assistants constitute a team with one thought —human welfare.

The dental and medical professions took up anesthesia slowly at first. Nitrous

*Read at the Seventieth Midwinter Clinic of the Chicago Dental Society, Feb. 27, 1934.

oxide was adopted by dentists, with some exceptions; while ether, chloroform, the heavier vapors became the favorites of the physicians. It is curious to note how long this separation was maintained. It is also interesting that, for years, physicians were barely tolerant of nitrous oxide. Many would not concede that it possesses true anesthetic properties. My own early observations of demonstrations almost compelled me to agree with them. Nitrous oxide, as you know, administered in the old crude way, produced asphyxia, seldom true anesthesia.

Then followed an evolution in the ways and means of administration. Andrews, of Chicago, added oxygen to nitrous oxide. With the mixture, an improvement in anesthesia followed. Inventors and manufacturers became interested. One apparatus followed another in popularity. It became apparent that the best machine must have several qualifications, such as ease of manipulation, and it must be capable of delivering definite quantities in certain units of time, and of delivering definite mixtures, and with definite pressures. The demands brought upon the market fifteen different machines. I, myself, demonstrated twelve different makes before a postgraduate class at Northwestern University Dental School in one afternoon, because a member of the class wished to know what machine he should buy. As I could not answer for obvious reasons, I took the position that they would all work, because I thought at that time that the nitrous oxide and oxygen and the anesthetist irrespective of the machine used had produced the results. Good fortune was on my side that afternoon. Everything went well, but today I would not risk my reputation to be so impartial. It didn't please the manufacturers, but I can't blame them. Some had meritorious machines. Of others, the less said the better. Time has proved what a college demonstrator did not dare to assert.

A little more than fifteen years ago, the medical profession became interested in nitrous oxide; and what happened? This is a curious thing: Dentistry had used it for nearly a hundred years. Its very own child had gone through all the diseases, figuratively speaking, of early life. It had grown up, and was on the eve of entering on full service as an anesthetic agent. What then? Dentistry heard a siren, and abandoned the child and the anesthetic agent without a peer was taken up by the medical profession. The technic for its administration was improved. Every high class hospital is today equipped for its use. Listen to the seemingly extravagant statement by K. C. McCarthy, M.D., one of the country's leading anesthetists: "The improvement in gas machines allowed the anesthetist to develop his technic until now nitrous oxide and oxygen can be given successfully for every operation in the surgical repertoire."

The dental profession, in yielding to the blandishments of agents and promoters of substitutes for nitrous oxide is selling its heritage for a mess of pottage. If this anesthetic is good enough for adoption by the medical profession, it is good enough for retention by the dental profession. Moreover, by changes tending to the elimination of general anesthesia in practice, the dental profession is foregoing its inherited rights to general anesthesia. If the right to administer general anesthetics is not maintained in the ranks of organized dentistry, these rights will be curtailed by law. In some states and countries, the law requires that a doctor of medicine be present when a general anesthetic is given.

Personally, I always welcome a physician or a dentist in company with a patient. It implies, to a degree, a slight

shading of thorough confidence. It always helps patients of certain temperaments, and that counts. As my earliest experiences with nitrous oxide anesthesia were before student audiences in a public clinic, onlookers never disturb me. All I demand is quiet. Visiting physicians seem to enjoy hand-holding. Some of them do not give an anesthetic once a year. They have been in practice perhaps forty years or more and never gave nitrous oxide, and seldom have they seen it administered. One of these elderly physicians came to my office quite frequently. In a fatherly sort of way, he would take the patient's hand. She would go through the ordeal uneventfully and wake up almost immediately. Then he would beam on her with satisfaction, as much as to say with Will Carleton's bear story hero: "Betty and I killed the bear."

With nervous patients, the presence of the family physician is valuable. He abates fear, which is as harmful in certain types as traumatism, possibly more so. On the other hand, I have known both physicians and dentists to be as useless as a frightened relative, when help was needed. It is rather presumptuous for them to assume a rôle that tends to present the anesthetist and surgeon in the slightest degree as a minority factor when the outcome places major responsibility upon them.

My assistants are always my assistants. I never allow them to assume that they are anesthetists unless this is legally true. I do not think that we can afford to "show off" in such a serious situation. Anesthetists have a standard legal status. If our assistants are below this, carelessness in designating them to be what they are not is without professional or lawful warrant.

Up to this point the term "nitrous oxide" has been used. I shall continue its use with the understanding that I imply thereby, in my practice, a mixture of three gases, used as routine; i. e., nitrous oxide, oxygen and carbon dioxide. Attached to the machine, ready for instant use, should be four tanks. In one is nitrous oxide; in another, a mixture of 95 per cent oxygen and 5 per cent carbon dioxide; in another, pure oxygen, and in a fourth, pure carbon dioxide.

As I have said, in a great many cases, administration of nitrous oxide alone results in asphyxia with all the attending phenomena. When oxygen sufficient for the patient's basal requirement is added to the nitrous oxide, true anesthesia is obtained, with the retention of nearly normal color and normal vegetative functions like those of the heart and lungs. When only these two gases are used, it is often necessary to encourage the patient to breathe. This is obviated by adding the third gas, carbon dioxide, a respiratory stimulant. The three gas combination has advanced in favor during the last ten years. I have been using it for the last eight years with considerable satisfaction. With its use, there are few occasions for hurrying the patient through the first stage. Slow induction into surgical anesthesia, as a rule, is best. It is safer and it gives an atmosphere of leisure in place of hurry to operative procedure. At first demonstration, those accustomed to the "hurry-up-and-get-it-over" method become impatient; but once the underlying principles are understood, its adoption follows.

An explanation as to how anesthesia is produced is so simple that some are reluctant to accept it. To this class belong those who always desire an involved explanation. Like many of the problems of medicine and dentistry, its solution is found in the cell. Cells need oxygen to retain irritability. Deprived of oxygen temporarily, they become inactive and lose irritability. They sleep. Deprived of

oxygen for long periods of time, they die. That is the way anesthesia is produced. We deprive the tissues and cells partially of oxygen. We do it by substituting for oxygen agents that lend themselves readily to a reversion from the insufficient oxygen status of anesthesia to the normal without injury or death of cells and tissues.

Here is a question that might arise: If deprivation of oxygen produces anesthesia, why is not the whole body affected? Why are not all tissues anesthetized? We know that the fundamental or vegetative organs operate when the person is anesthetized. The heart and lungs keep up their work. Taschiro has brought out this truth: The metabolism rate varies in different tissues in the body. In other words, the rate of wearing out and building up varies. The greater the rate of change of a tissue, the greater its demand for oxygen. Of the tissues of the body, the nerves have the highest metabolic rate. Of the nerves themselves, the cortical layer has a higher metabolic rate than the medullary. The cortex has to do with sensation and volition; the medulla with the vegetative functions. If the inspired air contains less oxygen than one part to four parts of nitrogen, the cortical controlled functions are affected first; that is, feeling or sensation, consciousness and willing.

The higher the metabolism rate of any tissue, the greater its demand for oxygen. In the administration of any general anesthetic, there is a reduction in the normal oxygen. It follows, then, that the tissues and cells having the higher oxygen requirement will be affected first. This is precisely what happens. There is an anoxemia (reduced oxygen) in the cortical layer. The functions it controls, consciousness and feeling, are impaired. If the anoxemia is carried far enough, these functions are lost, and we call the condition anesthesia. The anesthetist's aim is to maintain the anoxemia only in the cortical layer, often a very difficult task. May we form in our own language a definition: "General anesthesia is a controlled or managed anoxemia."

You will recall that there are two types of respiration: the pulmonary, wherein the hemoglobin takes its oxygen from the inspired air; and the internal, wherein the hemoglobin gives its load of oxygen to the tissues and cells. If the anesthetic is nitrous oxide, the oxygen which the hemoglobin normally gives the cells is replaced. The nitrous oxide produces cell anoxemia by substitution. No chemical change takes place in the cell, unless, of course, the exclusion of oxygen is maintained too long, and even then the chemical changes would not be due to the chemical activity of nitrous oxide but to postmortem cell chemism. Cells and tissues very quickly recover normal activity unimpaired after nitrous oxide anesthesia.

If the anesthetic is ether, chloroform, ethyl chloride or even ethylene, anesthesia results, plus something else. Crile says:

> Ether anesthetizes the phagocytes as well as the man, and so places the patient in the position of a citadel when, at the hour of assault by the enemy, the defenders are asleep in the trenches. If nitrous oxide-oxygen be used, however, the phagocytes remain ready for action and the danger of infection is therefore lessened.

This statement covers the situation when solutions are injected also. The solutions are not selective. They affect phagocytes as well as the nerves. By "plus something else," I mean the chemical activity of the ether group. They are known as lipoid, or fat, solvent anesthetics. By virtue of this chemical activity, they curtail the exchange of oxygen for the anesthetic between the blood and the cell, and tissue degeneration fol-

lows, especially in the fatty tissues such as the liver and kidneys. This in a large degree accounts for the pendulum swing favoring nitrous oxide. If we had more competent nitrous oxide anesthetists, this movement would be accelerated. On account of the lack of latitude in nitrous oxide surgical anesthesia, i.e., the rapid and easy changes in the anesthetic threshold from too light to dangerously deep anesthesia, the nitrous oxide administrator needs to be sensitive, alert and keenly intelligent every instant during narcosis. The limit of usefulness with this anesthetic is almost commensurate with the ability of the anesthetist. Such experts as E. I. McKesson and K. C. McCarthy have demonstrated this.

If the deprivation of oxygen were confined to the cortex, as is usually true in brief anesthesia, all would be well. When anesthesia is prolonged, the anoxemia will probably extend to the medulla. When, as and if it extends to the medulla, we get symptomatic anoxemia. This is signalized by low blood pressure, embarrassed respiration and muscular twitching. It means that the vital and fundamental functions are being involved. Death is not far away. Symptomatic anoxemia occurs in the deeper and later stages. It should not be confused with cyanosis, which comes in the early stages. Cyanosis means that the hemoglobin is not carrying its proper load of oxygen.

In symptomatic anoxemia, if the distinguishing phenomena are recognized promptly and the anesthetic is nitrous oxide, restoration to the proper level can be obtained without delay by the use of ogygen under pressure; but if the anesthetic agent is of the fat solvent series, that is ether, etc., the patient is elevated out of the danger zone slowly, if at all, owing to impairment of the cells and the surrounding plasma. The benefits sought through surgical treatment are many times more than counterbalanced by the ill effects of lipoid solvent anesthetics.

Prolonged nitrous oxide anesthesia is out of place in the dental office. The hospital is the place for these cases. It is not practical to premedicate for anesthesia, in office operations; nor is it practical to have a blood-pressure instrument attached to the patient; yet if we accept what authorities advise, both of these procedures are right and proper in long operations. Symptomatic anoxemia is not readily recognized without proper equipment. There is no excuse for unnecessary risks. If death comes, the onus is borne not only by those in attendance, but also by the whole profession. It is rather selfish, if not unethical, to thus treat our confrères. If hospitalization is impossible, resort may be made to less suitable anesthesia.

I wish to emphasize the advantages of carbon dioxide administration. While oxygen corrects anoxemia, it has no such function as the stimulation of the respiration, except indirectly. Carbon dioxide is the recognized respiratory center stimulant. In the early stages of nitrous oxide anesthesia, breathing is satisfactory if carbon dioxide is used. During the operation and afterwards, its use corrects the tendency to cease breathing. One can hardly understand this unless from first hand experience. Administration of carbon dioxide increases the coagulability of the blood and controls hiccup and nausea after operation. Carbon dioxide can be used after operation to hyperventilate the lungs and thus help free them from the anesthetic. Combined with oxygen, it helps to counteract the lowering of the blood pressure that accompanies spinal anesthesia. I have had experience along this line.

Rationality will go a long way in developing the ability to use nitrous oxide

satisfactorily. The beginner must test his ability with simple cases; i.e., select patients who, according to the best knowledge and belief, will react to the anesthetic well and are to undergo operations that are relatively easy, well within the range of the operator's ability and of short duration. The patient should be thoroughly anesthetized by the slow method of induction. A slight anesthesia may have unpleasant sequelae, such as crying, screaming or even fighting. Nitrous oxide is such an innocuous gas that our patients experience no bad after-effects and we incur far less risk with a real surgical stage than with a primary.

Many times, novices attempt operations with nitrous oxide that would tax the resources of those of great experience. Unsatisfactory results discourage beginners. They do not give themselves a chance to develop. They condemn nitrous oxide and store the apparatus in the attic along with many other more or less useful things, such as porcelain furnaces, simply because they will not believe that "Rome was not built in a day."

Nearly every one who writes on this subject mentions the need of self-confidence. I will refer to it only in this way: It is as necessary as any part of our equipment. I cannot imagine a successful anesthetist without it. Even the patient senses its absence or presence. Every anesthetist experiences apprehension. This is not the opposite of self-confidence. Apprehension comes from knowledge of the subject. It represents a realization of the possibilities as weighed against the improbabilities. It saves the anesthetist from foolhardiness. However, apprehension must be disguised.

Good surgeons may be perturbed in the presence of nitrous oxide anesthesia. This unfits them for service in conjunction with it. From somewhere in the past, they retain the old hang-over of hurry. That was the watchword of the old days of nitrous oxide asphyxia. I do not use the word "asphyxia" sarcastically. It describes with scientific accuracy the situation in all too many of those bygone administrations of nitrous oxide. If surgeons are too old, or too set or too self-satisfied to retrain themselves to the atmosphere of the wonderful attainments in modern nitrous oxide anesthesia, the while forgetting the old methods, I say to them, with due consideration for their past services: Continue to serve as you do to the end; but I would ask them not to discourage the young without an investigation of the facts concerning improved technic. In any case, the truth will prevail.

It is not enough to say that the new technic in nitrous oxide anesthesia has a future. It has arrived.

I have heard fairly responsible men say that nitrous oxide is the most dangerous of anesthetics. That would sound alarming unless we went behind the statement to the facts. Statistics contradict the statement. Men of intimate and vast first-hand experience with nitrous oxide contradict the statement. Let it be understood that nitrous oxide presents almost a paradox. It is the safest and the most dangerous of anesthetics; but not at one and the same time and under identical conditions. It is the safest for all manner of risks, if the anesthetist is competent; otherwise, quite the contrary. Its untoward effects are immediate. *Per se*, it has no sequelae. Its safety, then, depends on immediate recognition of untoward effects and the prompt use of remedial measures. Ether is almost the exact antithesis of nitrous oxide. Its untoward effects are slow in making their appearance. The anesthetist may be slow in recognizing them. They cannot be dispelled rapidly. *Per se*, it often has sequelae of

grave import, many times beyond medical skill.

While nitrous oxide anesthesia is difficult, it is within reach provided the person who wishes to become adept in it is truly willing to take up its study with seriousness. Real ability in any worthwhile undertaking will not develop by some lucky stroke. Failure always has certain elements of the personal equation. Treat the subject of anesthesia fairly and, unless your characteristics are such as to render you unfit, you will succeed.

A well-administered anesthesia is a thing of beauty as well as utility. The best anesthetists are artists who take pardonable pride in their work. To obtain the best results requires true professional spirit. With it, a new patient is not "just another case." Enthusiasm over each administration will make every succeeding one better than the last. This spells just one thing—growth. With development, you will take the interest in books and essays on the subject that they deserve, and like them.

The underlying principles of anesthesia carry through all cases; but they have almost numberless variations from the typical. It is here that experience plus study and enthusiasm enables one to render better service. After 100,000 cases, one should be good; but, again, that depends. The anesthetist has to solve his problems when they arise. He cannot take them under advisement and deliberation as the lawyer does his problems.

Chiefly on account of the variabilities in cases during narcosis, no mathematical anesthetic formula can be laid down. If one tries following formulas, failure will result more often than success, and failures are discouraging. That is why we have in dental attics quite a number of machines out of commission and covered by cobwebs. The percentage of gases used not only varies with the individual; but also varies at different stages of the same administration. It is more important that we know all about the patient in anesthesia of long duration than it is in administrations. A metabolism test, for example, will give the oxygen requirement. This knowledge, coupled with a knowledge of the clinical symptoms of oxygen starvation during anesthesia, will go a long way in the direction of safety. Possibly the expression of Dr. McKesson is better, "oxygen-want." He also uses the expression "minimum oxygen per cent," explaining that he means the least amount of oxygen a patient can live on for such a period as ten minutes without showing symptoms of oxygen-want. In practice, after ascertaining the oxygen requirement, the state of the patient as he progresses through the narcosis is the best test of optimum requirement for surgical anesthesia.

Anesthetizing patients suffering from an acute infection such as the sudden flare-up of a chronically abscessed tooth presents difficulties hard to cope with. In these cases, the metabolism rate is abnormally high, and therefore the oxygen requirement is high. If we satisfy this, we will, according to my experience, have a difficult time with the patient. If we do not satisfy the requirement, asphyxial symptoms, with cyanosis, arise. I prefer the latter, for very short administrations, and I am quite sincere in an effort to help. It is not ideal. It is practical. Furthermore, an anesthetist can rarely transform a poorly begun anesthesia into a satisfactory one.

That I may not be misunderstood, let me hasten to add that the "practical" I referred to applies only to short cases. With an extremely high oxygen requirement, the entire matter as to whether to anesthetize or not to anesthetize should be taken under serious advisement for long administrations. Postponement, if pos-

sible, until the acute condition has abated would be best. On the other hand, we find acute conditions in other parts of the body beside the oral cavity. In acute appendicitis, for example, immediate operation is often imperative. Here, the resources of the anesthetist are taxed to the limit. If nitrous oxide proves inadequate, ether or ethylene must be used; but even here nitrous oxide again proves its usefulness in preliminary anesthesia.

Speaking of prolonged nitrous oxide anesthesia again, let me voice a warning: After ten minutes of administration, the dangers increase rapidly. If the operation requires a long time, a medical examination should include a report on the basal or minimal oxygen requirement and the thymic condition. A persistent thymic disturbance in adults, if diagnosed, would contraindicate a general anesthesia. Furthermore, a hospital is the place for a long nitrous oxide anesthesia. Hospitalization renders premedication possible; protects the surgeon and the anesthetist against possible and sometimes plausible criticism, and serves the best interests of the patient. I repeat: If hospitalization is impossible, other anesthetic agents should be resorted to.

In justice to the subject as a whole, mortality must be considered. Experienced anesthetists know full well that when the lower thresholds of anesthesia are reached, death is not far away. Death comes from the anesthesia at times. It comes also from surgical shock. Sometimes, it comes from a combination of the two, and at times inexplicably. While sudden deaths occur in bed, on the street, on the golf course and in divers other places, the anesthetist knows full well that death during anesthesia makes news for the front pages of the daily papers; moreover, these papers are not magnanimous enough to make a conspicuous place for the necropsy findings. In this way, great personal wrong is done, and the public gets an erroneous idea, which is reflected on anesthesia in general.

Sometimes, thoughtless and irresponsible members of both health professions have dropped remarks in connection with specific instances which border on the unethical. If any comment seems necessary, would it not be better to share the responsibility by saying, "It might have happened to me"? When all the evidence is in and when due consideration is given to the great variety of favorable and unfavorable conditions under which nitrous oxide is administered, and in fact, all other anesthetics, and when the degrees of proficiency with which it is administered are weighed, it must be admitted that anesthesia *per se* as a cause of death is, relatively speaking, very rare. This fact constitutes no cause for carelessness, but rather encourages those engaged in the practice of anesthesia, either as general practitioners or as specialists, to maintain its high standing.

Of equal importance to the study of anesthesia is an acquaintance with emergencies connected therewith. To know what to do is no more important than to have handy the equipment for the care of emergenices. A few restoratives such as aromatic spirits of ammonia and a hypodermic of strychnine sulphate, illustrates briefly what I have in mind. Or your own choice of regulation restoratives should be within reach ready for instant use. The time element may mean death or life.

SUMMARY

1. Inhalation anesthetics are often contraindicated in cases of respiratory difficulty. Aside from these, nitrous oxide, in the hands of an expert, is the safest anesthetic.

2. Barring unfavorable sequelae, ether, in the hands of the untrained as well as

the trained, is the safest anesthetic for nearly normal patients.

3. Barring respiratory obstruction, a patient who is too sick for nitrous oxide anesthesia cannot take any anesthetic, nor endure much surgical work.

4. Nitrous oxide may be given during pregnancy by the slow induction method. I have used it a great many times, once within twenty-four hours of childbirth, without a single mishap. The contrary opinion is based upon tradition for the most part. Under operative necessity, I think it best to use a general anesthetic, and nitrous oxide is the safest.

5. I have administered nitrous oxide to patients with grave cardiac disorders under the supervision of heart specialists. These are serious risks, but they fall to the lot of anesthetists and they must be assumed.

6. Nitrous oxide does not impede recovery after operation. This is frequently untrue of the lipoid solvent group anesthetics.

7. Untoward effects from inhalation anesthesia, especially nitrous oxide, are often corrected by withdrawing the anesthetic entirely and substituting pure oxygen under pressure, thereby reducing the dosage. In idiosyncrasies accompanying injection anesthesia, the dosage cannot be reduced. Drugs must be used to counteract, if possible, the ill effects of the solution. When a dentist has to resort to such, he is practicing medicine to as great a degree as the dentist who administers a general anesthetic. Furthermore, both must be possessed of the equipment and means for emergencies and with knowledge of how and when to use them.

8. Nitrous oxide is an adequate and ideal anesthetic agent for at least 95 per cent of exodontia cases. Success with it is directly proportional to the ability of the anesthetist.

APPLICATION OF THE LINGUAL ARCH IN THE TREATMENT OF MALOCCLUSION OF THE TEETH*

By ERNEST N. BACH, D.D.S., Toledo, Ohio

HISTORY

THE use of the lingual arch in its variations has proved to be a quite effective means of treatment of irregularity of the teeth. I speak of variations because of the many shapes, sizes, etc., which have been designed and used by operators in the specialty of orthodontia, and years before orthodontia was a specialty. Before we consider the lingual arch as we know it today, I shall briefly review the history of this appliance.

The introduction of the first important regulating device was recorded 200 years ago. Pierre Fauchard, in 1723, introduced this appliance, although he mentions the fact that it did not originate with him. As far as records show, there were few appliances mentioned before this time. The chief purpose of Fauchard's appliance was to expand the arch by means of a bow or band, or bandelette as is was called. It was more or less what we term the expansion arch of today.

In 1757, Bernard Bourdet devised two

*Read at the Seventieth Midwinter Clinic of the Chicago Dental Society, Feb. 28, 1934.

bands or strips of metal, each pierced with twenty holes. The bands extended from the second molar tooth on one side to the second molar tooth on the other side. Ligatures were passed through these holes and tied around the teeth. A lingual band was used when teeth were to be retracted, and a labial band when teeth were to be brought forward. This appliance, which is similar to Fauchard's, may perhaps be termed the first lingual arch.

J. B. Schange is accredited with being the first to employ the clamp band. He used it on a malposed central incisor instead of entirely as anchorage. This was in 1842.

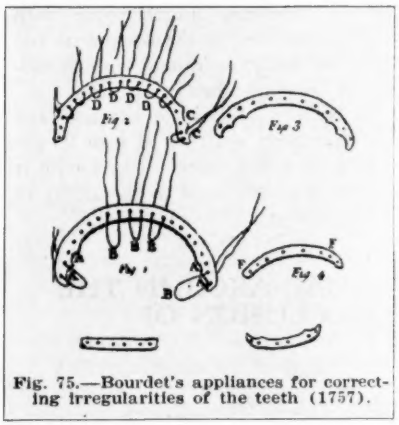


Fig. 75.—Bourdet's appliances for correcting irregularities of the teeth (1757).

Fig. 1.—Bourdet's appliance. (1757.)

In 1745, W. H. Mortimer describes a bite plane attached to the lower lingual arch to "prevent the under teeth from closing outside the upper teeth."

James Robinson, in 1859, introduced the first coil spring for lingual appliances. He made a palatal plate of a denture (bone) and drilled holes in this plate in the direction of the anterior teeth which were to be moved forward.

In 1850, John Tomes used a metal plate with plain springs soldered to it to move and rotate the teeth. The plate was held in place by buccal clasps between the bicuspids on one side and second bicuspid and first molar on the other.

George T. Barker, in 1862, gave out his idea regarding expanding the arch. He used a "simple silver plate struck up to fit the roof of the mouth." It was retained in the mouth for the first few weeks by silk ligatures, one around each of the bicuspids, but, in a short time, "the patient would each day remove it herself,

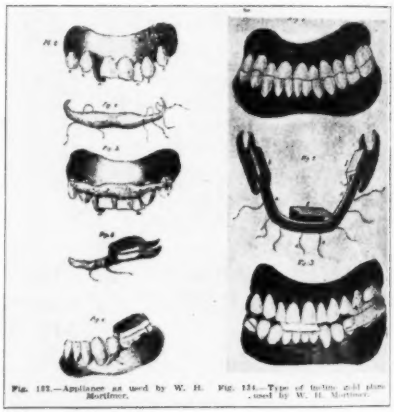


Fig. 2.—Mortimer's plane. (1745.)

expand the plate and introduce it." In two months, three-eighths inch in width had been gained between the first bicuspids.

As far as I can find, William Gibson Arlington Bonwill was the first to design a lingual arch, 1863, which approaches the lingual arch as we know it today. I believe he was also the first to use spiral springs attached to a lingual arch. His arch was soldered to clasps or clamps which, in turn, held it to the molar teeth.

The jackspring, first introduced at this

time, was very similar to the ones used today. The single and double threaded jackscrews were also placed on the market about this time.

Fig. 3.—Tomes' springs. (1850.)

front of the upper incisors. The principle of the bite plane of fifty years ago is identical to that which we use today.

S. James A. Salter, in 1875, used caps on deciduous molar teeth, on the occlusal surface of which a heavy bar was soldered. Its purpose was to open the bite.

John Joseph Ravensport Patrick, in 1882, before the Illinois State Dental Society, gave his new and novel method of alining teeth in either arch. I believe that he was the first to use molar bands for anchorage and buccal tubes for the labial

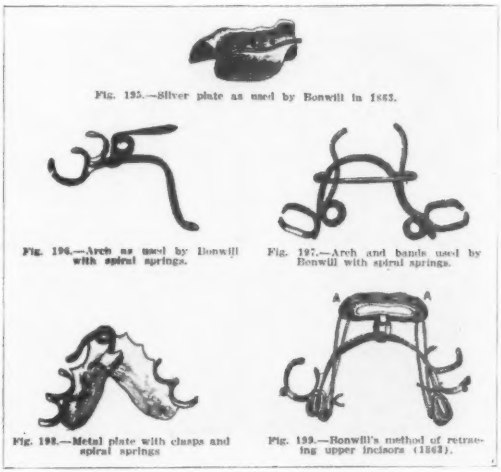


Fig. 195.—Silver plate as used by Bonwill in 1863.
Fig. 196.—Arch as used by Bonwill with spiral springs.
Fig. 197.—Arch and bands used by Bonwill with spiral springs.
Fig. 198.—Metal plate with clasps and spiral springs
Fig. 199.—Bonwill's method of retracting upper incisors (1863).

Fig. 4.—Bonwill's appliances. (1863.)

In 1877, Norman William Kingsley demonstrated the use of the jackscrew in connection with a mandibular lingual vulcanite plate. The plate was split and "elastic straps" were attached to the extremities. In the same year, he introduced the vulcanite bite plane for bringing the lower jaw forward. He also used it to move the prominent maxillary incisors distally by passing rubber bands through a hole in the bite plane and attaching them to a hook. The other end of the band engaged a labial bar worn across the arch. In 1877, he introduced the "clamp band" for molar teeth.

In 1855, J. A. Woodward made a band matrix of phosphor bronze with a screw of piano wire, clamping the ends together. This, undoubtedly, is the predecessor of the overlapping clamp band.

Thomas L. Gilmer, in 1873, banded a bicuspid on one side, and a bicuspid and first molar on the opposite side, and connected these sections by a soldered palatal bar. A horizontal tube was soldered on the lingual aspect of the bicuspid and

molar band. A spring of piano wire was inserted in the tube and a hook made on the free end of the spring to which ligatures might be attached. This is believed to be the first removable lingual appliance.

Arthur E. Matteson, in 1892, introduced a lingual appliance in which he used horizontal tubes soldered lingually of the molar bands, with the adjustment of a nut on the threaded arch to produce the desired pressure.

Calvin Suveril Case, in 1898, used horizontal lingual tubes and a lingual arch, connected by a jackscrew across the distal aspect of the mandibular incisors, for use in expansion.

Fig. 217.
ivation of the jackscrew (1877).

Fig. 219.—Kingsley's application of the inclined plane (1877).

Fig. 5.—Kingsley's appliances. (1877.)

From the foregoing brief history of the lingual appliance, it will be seen that 180 years ago, certain scientific men were working on the correction of irregularities by using the bow or band on the lingual side of the arch for retraction of the teeth.

History is not definite on this point, but, as far as it is possible to determine, the actual discoverer of the lingual arch as we know it today is not known.

Lloyd S. Lourie and John V. Mershon are accredited with having been the first to use the lingual arch, although neither will claim to have actually originated it. To Dr. Mershon is given the credit for being the first to employ the half round pin and tube for a lingual lock; and to Dr. Lourie, credit for developing the soldered lingual arch.

In describing the lingual arch and its relation to the treatment of malocclusion, the greater part of the construction side has been purposely omitted. This to be taken up in the demonstration which is to follow.

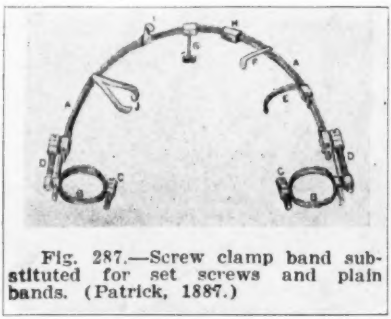


Fig. 287.—Screw clamp band substituted for set screws and plain bands. (Patrick, 1887.)

Fig. 6.—Patrick's bands. (1887.)

The lingual arch is divided into two main groups: 1. The fixed or soldered arch, which is soldered to bands. 2. The removable type, which can be removed without taking the bands off the teeth.

In order to present the question of the lingual arch in a fair manner I have sketched a number of arches and springs that have been used in recent years, stating the purpose of each, with its advantages and disadvantages.

Figure 9 is perhaps the best illustration of a soldered lingual arch. This type is

used by Lourie. The lateral sections were adapted to the lingual surfaces from the molar to the cuspid teeth, passing straight across to the opposite cuspid and from there to the molar. By use of the wire stretching plier, Lourie was able to produce pressure in the direction of the straight wire, and to tip or rotate molar teeth.

Figure 10 shows another type of arch, that in which loops are made in the arch between the cuspids. By opening the loops, expansion is gained from cuspid to molar region. The cuspids should be banded and lingual spurs used.

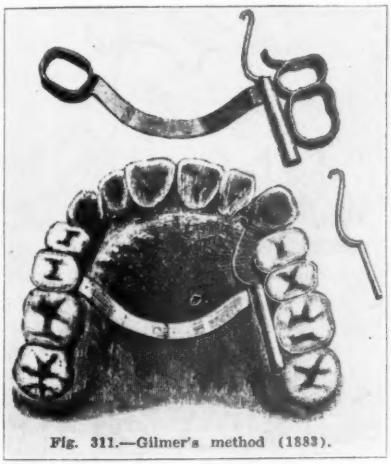


Fig. 7.—Gilmer's removable appliance. (1883.)

Figure 11 shows another appliance, in which one or more loops are made in the arch between the cuspids, and also between the cuspids and the molar teeth, as the case may demand. The success in using any one or all three of the soldered lingual arches just described lies chiefly in the experience in their use, and in good judgment. One fact alone, namely, that the ends of the arch are soldered to the molar bands, makes uncertain the resultant force when the wire is stretched or the loops are opened or closed.

The soldered lingual arch is now used principally in the capacity of a retaining appliance. If one wishes to try the wire stretching technic or adjusting the loop appliance, a removable type of arch is advised. Observing the effect on the end of a lingual removable arch after adjustments have been made will help the operator to determine whether his judgment was correct in making the intended adjustment.

The removable lingual arch possesses many advantages and, of course, disadvantages. The former you are familiar with, in that it can be removed for adjustment, springs can be added or repaired, changes can be made to allow for progress in a case; etc.

Fig. 8.—Matteson's appliance. (1893.)

The main disadvantage lies in the fact that there is more breakage of the arch wire than of the soldered type. This may be due to the extra heating during the soldering process for lingual lock attachments. This will be referred to later.

Another disadvantage arises in the instability of the lingual locking device after a few months' service; and, lastly, the difficulty many times of removing the pin section of the lock from the tube. This is overcome, for the greatest part, by the use of pliers designed for that purpose.

Any of the following types of arches may be of a fixed or removable type, although the removable is preferred.

The jackscrew for individual tooth movement is now in little use, as full correction of the malocclusion is anticipated rather than the correction of the malposition of one tooth.

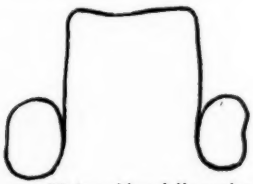


Fig. 9.—Plain soldered lingual arch.

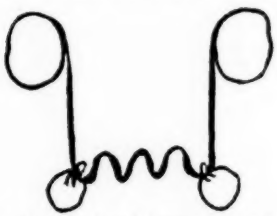


Fig. 10.—Soldered arch loops between cuspids.

Figure 12 illustrates a plain lingual removable arch shaped to engage the lingual surfaces of the buccal teeth, including the cuspids. Part of the arch section between the cuspids is replaced with a Barnes power tube or other screw arrangement exhibiting the principle of the jackscrew. By proper adjustment, lateral pressure may be produced on the buccal teeth from cuspid to molar. The cuspids, either deciduous or permanent, should be banded and a spur soldered on the lingual surface to engage the arch for purposes of stability. This simple appliance is effective and positive. We use it whenever possible, especially on the mandibular arch in mixed dentures. After sufficient expansion is gained, the anterior teeth are brought into position by two plain curved springs soldered to the lingual arch to engage the anterior teeth. A labial arch may also be used for this purpose. After teeth are in their relative position, the Barnes tube or threaded arch section is replaced by a plain wire engaging the lingual surface of the teeth near the incisal edge.

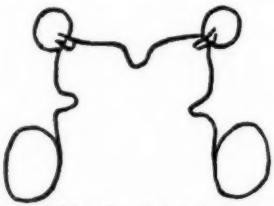


Fig. 11.—Soldered arch loop between molars and cuspids and cuspid and cuspid.

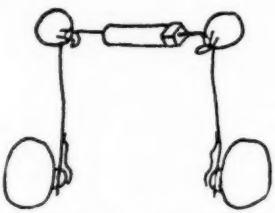


Fig. 12.—Removable lingual arch. Barnes tube between cuspids.

Figures 13-14 show lingual arches described by Case. (I do not know that these were original with him.) Figure 5 is a plain lingual arch, the ends of which consist of a threaded section and nut. These are inserted into horizontal tubes soldered on the lingual surface of the molar band. Figure 6 shows a similar arch, the anterior section having been replaced by a jackscrew arrangement so that additional adjustment of the nuts

produces pressure in an anteriorposterior direction. Adjustment can also be made laterally.

Figure 15 illustrates a similar type and one which was designed by L. J. Porter. His appliance differs principally from the previous ones in two respects: 1. The arch wire does not contact the teeth. Dr. Porter uses a Barnes tube in the anterior section and the adjustment of the tube transmits a spring pressure instead of having a direct jackscrew effect. 2. Long springs are attached to the arch in the region of the second bicuspid and extend to the incisors.

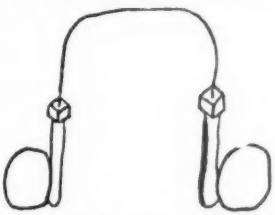


Fig. 13.—Threaded arch ends fitting tubes soldered horizontally to molar bands.

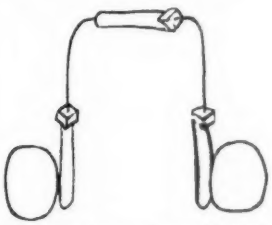


Fig. 14.—Appliance shown in Figure 13, with additional adjustment in anterior section.

Figure 16 illustrates an arch and loop of similar construction. The loop extends around, and in contact with, the incisal labial surface of the four or six anterior teeth, while the main arch or similar loop makes contact with the incisal lingual surface. The approximating of these two wires produces the rotation of malrotated teeth, and also serves as a depressor of the anterior teeth. Lingual occlusal spurs or rests on the tooth next distad from the banded tooth are soldered on the lingual aspect of the molar band. These stabilize the banded molar tooth as well as the arch.

Figure 17 shows the appliance which we favor for the maxillary lingual arch. It has been described on other occasions. The noticeable feature of the appliance is the shape and position of the arch. It is adapted to lie in close proximity to the soft tissues and crosses the palate in the region of the second bicuspids. The palatal position of the arch eliminates lisping and tissue irritation, especially when in contact with the lingual fibers of the labial frenum. Because of its design, this lingual arch is free of interference from the mandibular incisors. The plain springs are so attached as to be adjustable and engage only the two bicuspids on either side.

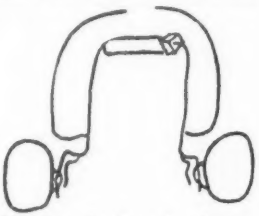


Fig. 15.—Design after Porter.

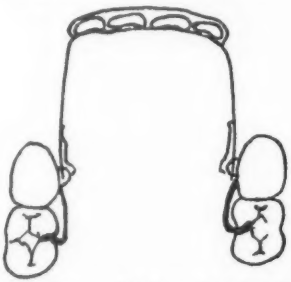


Fig. 16.—Removable lingual arch stabilizers on second molar teeth; loop on labial surface of incisors.

Figure 18 is designed in a similar way, with plain long springs engaging all the teeth on either side from the anchor tooth to and including the incisors. Spurs on cuspid bands assure stabilization of the springs, but a spring of this length is not desirable even though stabilized by spurs or lugs. It is very difficult, although possible, to adjust so long a spring to produce desired pressure on selected teeth.

Figure 19 illustrates a lingual arch with incisal hooks or finger springs which engage the incisal edge of the incisors and

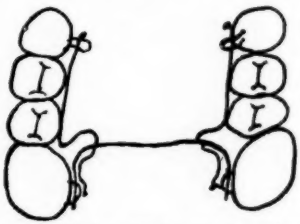


Fig. 17.—High palatal arch; lateral springs to cuspids and bicuspids.

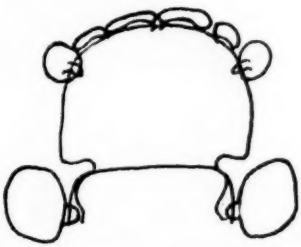


Fig. 18.—Appliance shown in Figure 17 except that springs extend to incisors.

are soldered to the lingual arch directly distad from the tooth. Although these teeth may be depressed with this appliance, lingual extensions and occlusal rests should be provided on the teeth next distad from the anchored teeth. Otherwise, the crown of the anchored teeth will tilt distally and the roots mesially.

Figure 20 shows how attachments may be made to the lingual arch. It then becomes the support of a bite plane, as described by Pullen, Porter, Oliver and others, consisting of a crib against which the mandibular incisors strike. The finger hooks to the incisor teeth, just described, well serve their purpose in this appliance.

Since this paper is dealing with the lingual arch in relation to treatment, we have not considered it in the capacity of a retaining appliance.

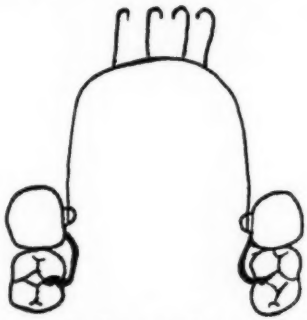


Fig. 19.—Appliance similar to that shown in Figure 16, with finger extensions to incisal edges of anterior teeth.

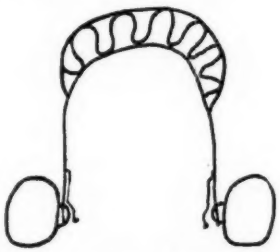


Fig. 20.—Bite plane crib.

Here a few words might be said in regard to the materials used by early practitioners, in comparison with those which are used today.

Before the process of vulcanizing rubber was discovered, in 1839, so-called regulating appliances were rather meager. They consisted of material which would

best serve the purpose. Wooden wedges and bamboo were first used, being followed by "bands" or "arches" made of gold-platinum or silver. After the discovery of the vulcanite process a combination of rubber bands or arches were used, as they still are today, mostly in the form of retainers.

The materials used today for arches, bands, springs, etc., consist chiefly of an alloy of gold, platinum, palladium and iridium. By varying the amount of each of these constituents in an alloy, a number of alloys can be made with consequently varying qualities. Especially is this true

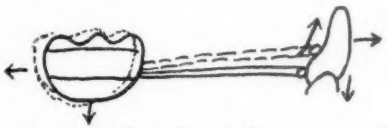


Fig. 21.—Effect of excessive pressure of lingual arch on anchored tooth and anterior teeth.

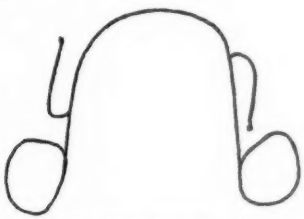


Fig. 22.—"L" shaped springs.

if a base metal such as copper or nickel be added.

The alloys we are using today are materials capable of being made hard or soft by laboratory methods. Wires are easily bent in their annealed state. The wires may be annealed by being heated to a cherry red and quenched immediately in water. Lingual arches, springs, etc., are more easily adapted in this condition than in the springy or hard state, and are less liable to fracture. A wire which is soft possesses less springiness than one which is hard. As a result, one which is hard, and in turn possesses much springiness, will fracture more quickly, especially on sharp bends during the cross-bending process. The reverse being equally true, a soft wire, or one which possesses less spring, will stand more abuse of the kind encountered in making short bends around lingual locks and springs.

A wire should be annealed before any severe bending is done as there is less possibility of fracture while in this state. Tempering should be done after the appliance is formed.

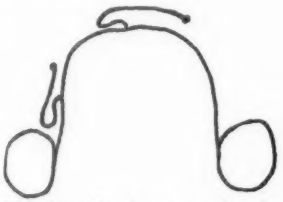


Fig. 23.—Simple recurved springs.

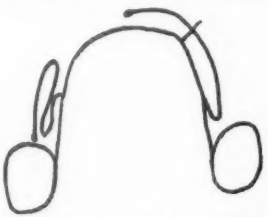


Fig. 24.—Double and single recurved spring.

There are two specific ways in which degrees of hardness may be produced:

1. By heating to a dull red heat and allowing to cool in air. The springiness or tensile strength increases 20 per cent, and ductility (softness or ease of being worked) decreases 40 to 60 per cent depending on the platinum group present in the alloy.

2. By heating as before and allowing to cool by the "oven-cooled" method. This process, as described by the Bureau of Standards, consists of placing the wire

in a furnace at 1290 F. for ten minutes, and immediately quenching in water at room temperature. Heating again in an oven to 840 F., then uniformly slowly cooling to 480 F. in thirty minutes. The tensile strength is increased 12 to 15 per cent, and ductility or softness decreased 40 to 60 per cent over those of the "air-cooled" process.

3. By heating to a cherry red and quenching immediately in water; which of all the heat treatment methods produces the softest wire.

In plain terms, this means:

1. When a wire is heated to dull red and immediately quenched in water, it becomes softer, losing considerable of its springiness. As a result, it will stand

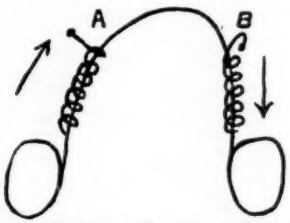


Fig. 25.—Pushing coil spring and retracting coil spring.

strains and not fracture so easily at short bends as one which is not annealed.

2. A heat-treated soft wire which is allowed to cool in air regains a considerable amount of its hardness; consequently, it is more liable to fracture and will not stand much abuse.

3. When the soft heat-treated wire is "oven-cooled," it becomes harder and produces an extremely springy wire. Necessarily, the wires fracture easily from repeated strain such as is produced by tongue manipulation.

In spite of the careful alloying and making of these materials by the manufacturer, and in spite of careful and exacting heat treatment in our laboratories, we experience frequent breakage of lingual arches. Assuming that the foregoing manufacture, and the heat-treatment in the laboratory, have been diligently carried out, there remain other possible causes for arch failure over which we have control.

The first to be mentioned deals with heat employed during the soldering operation; another, with the kind of solder used, as well as the amount; and the last, with mechanical forces, such as interference with opposing teeth and manipulation of wires by the tongue.

I quote from a previous paper regarding this point:

The melting point of solders must be sufficiently low to permit flowing without

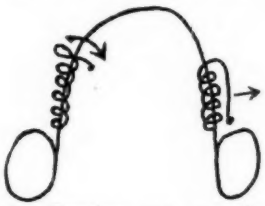


Fig. 26.—Rotating and expanding coil springs.

causing distortion of the wire upon which it is used. Gold alloys—as well as others—are composed of grains of varying sizes. When some gold alloys are heated nearly to their melting point, several of the small grains unite to form larger grains or crystals. Although the shape of the wire does not change, this is one reason why it becomes brittle and weak. A solder which in melting requires an amount of heat to cause grain growth in an alloy is undesirable—even though a good joint may be made, with no distortion taking place in the wire. The longer the high temperature is maintained, the greater becomes the possibility of fracture although no outward signs are visible.

When making soldered joints use only sufficient heat to thoroughly melt the solder, and do it quickly. A good wire

can be made very brittle by an application of a few extra seconds of concentrated heat, such as is used in soldering. Flux is applied at the desired point and the solder is held to the wire until melted. It is touched again with flux and the heating process repeated while the desired wire is attached, the operator working as quickly as possible with a concentrated flame.

Gold solders are similar to wires in their reaction to heat treatment. The finest generally used are 18k, 16k and 14k. All show the greatest percentage of elongation (ductility or softness) when quenched. If they are allowed to "air-cool," the hardness increases 35 to 50 per cent. If they are "oven-cooled," the hardness or stiffness increases approximately

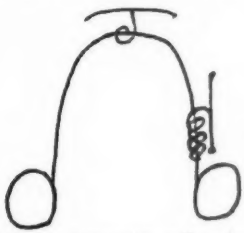


Fig. 27.—Expansion coil springs.

50 per cent over that resulting from the "air-cooled" method.

From the foregoing, we may draw the conclusion that wires are less apt to fracture at soldered joints if these areas are immediately quenched in water after soldering or reheating. A solder of reasonably high precious-metal content and low fusing point will provide the best union of parts.

Joints to be soldered should fit tightly together.

The smallest amount of solder possible is used to make a good joint.

Excess solder is often a detriment as well as a waste.

The larger wire is heated first.

The solder is coated with flux before heating, the process being repeated after heating.

Soldered joints should not be located at points of maximum stress.

Soldering is done on a black background.

There are two main places of interference of appliances by opposing teeth: In one, the tubes for lingual locks on the maxillary molar teeth are soldered too near the incisal edge of the band. As a result, the arch at this point would be very close to the occlusal surface of the tooth and consequently strike the opposing tooth. This repetition of blows soon causes a breakage at that point.

The other place is in the region of the maxillary incisor teeth, where the man-

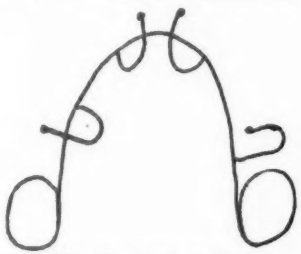


Fig. 28.—Loop springs.

dibular incisors strike against this arch.

Still another cause may be attributed directly to the patient; namely, manipulation of the wire by the tongue or fingers. Repeated bending of the wire usually causes breakage in the region of the lingual lock.

The one remaining phase of the lingual arch and its application in the treatment of malocclusion is the part played by the auxiliary springs.

AUXILIARY SPRINGS

Plain springs applied in the inside of the arch have been used in orthodontia since the time of Tomes, in 1880. About

forty years later, Meissen Siegfried introduced the coil spring, which he used on both lingual and labial arches. Thus, the story of auxiliary springs is not new in our field, but size, shape, design and application are relatively new, with variations according to the idea of the operator.

Fundamentally, the types of lingual springs used in orthodontia may be divided into the plain spring with its variations, the coil and the spiral spring. While this classification may not be technically correct, these types are extensively used in connection with lingual arches today.

For purposes of clearness, Figures 22-30 have been prepared, showing a number of springs and attachments.

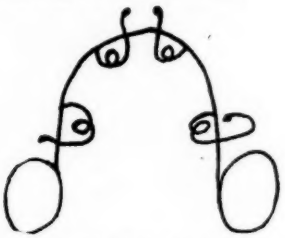


Fig. 29.—Spiral springs.

Fig. 30.—Double loop springs.

SUMMARY

1. Practically all appliances used in orthodontia today have been developed within the last 100 years.

2. The year 1863 marks the design of a lingual arch which resembles the one that we now know. Ten years later, the first removable lingual arch was demonstrated. The principles of the clamp band for anchorage, and the buccal tube for labial arches, were introduced about fifty years ago.

3. Lloyd S. Lourie and John V. Mershon are accredited with using the first lingual arch as we speak of it today.

4. With few exceptions, lingual arches conform to a general shape.

5. In making appliances, the operation should be performed with the wires in an annealed condition, they being tempered after the appliance is made.

6. Fracture of wires is often due to carelessness in the use of heat while making the appliance, and not to faulty heat treatment.

7. Joints and wires are less liable to fracture if quenched immediately after soldering.

8. Regardless of the size and shape of springs, there always occurs a resultant pressure on the lingual arch and its attachments whenever tension is put on them. To figure the place and amount of this pressure is not simple.

9. In cases requiring general expansion, a lingual arch with springs engaging the two bicuspids on either side is used quite successfully, the labial arch being used in connection with the six anterior teeth, where long springs are not so effective in producing desired pressures.

10. As a rule, the simpler the spring, the less the trouble encountered in its manipulation and the more positive its action.

11. The application of spring force approaches the ideal in producing mechanical stimulation for bone changes.

ORAL HYGIENE AND PREVENTIVE MEDICINE*

By IAGO GALDSTON,† M.D., New York City

WERE I this evening to follow common practice and take full advantage of the prerogatives of a commencement essayist, I should roundly belabor you with a dissertation on man in general and life in particular.

Instead of indulging in all of those grandiose gestures which are so much a part of the average graduation address, I shall content myself with a smaller thesis, limiting my remarks to the consideration of oral hygiene in relation to preventive medicine, and I shall console myself in this modest task with the thought that Rome was once saved by the cackling of geese.

It is said, and said wisely, that definition is the soul of argumentation. With such a thesis, I think it proper to spend some time in defining our understanding of oral hygiene and of preventive medicine. I shall not, for there is no need to, dwell on oral hygiene. You are, in this respect, palpably more competently informed than I am. But I will attempt to define preventive medicine, and this subject can best be delineated through a historical approach.

One of the common boasts of today is of the progress that we have made in the conquest of disease. There is not a single instructor in elementary biology in any of our public schools who does not, several times in the year, run through the gamut of recitation, "pointing with pride," to the fact that modern medical science has overcome most of the plagues that beset our forefathers. To count them off, there are smallpox, cholera, typhoid, diphtheria, yellow fever, malaria, tetanus and a host of other diseases which plagued and harassed our ancestors and which have become to us little more than diseases of passing significance. These, modern science has overcome.

The story is an impressive one, but the din of its repetition dulls our appreciation of the nature of the forces that operated to achieve this conquest of disease, and of what further bearing these forces may have on the medical problems of today. By dwelling too closely and too persistently on these great achievements in medicine, we, like the second generation of a pioneering family, are liable to forget that field and mine and stream, no matter how fertile or rich, must inevitably, and after intensive exploitation, turn barren and become empty.

In other words, though we may look with satisfaction on the achievements of medical science in the conquest of disease in time past, we must also critically question whether the forces that operated in our past achievements will serve us as effectively today. If so, we may merrily sing on, but if we must seek for new ways, we must change our tune. I need not, of course, keep you in suspense. I may at once reveal to you my conviction that the ills of today call for new

*Read at the Commencement of the Murry and Leonie Guggenheim Dental Clinic, School for Dental Hygienists, New York City, June 21, 1934.

†Secretary of the Medical Information Bureau, New York Academy of Medicine.

remedies; that the methods of yesterday —those that proved so effective in the conquest of smallpox, diphtheria and typhoid—will not serve in overcoming heart disease, the psychopathies or the oral diseases.

What were these forces that operated yesterday in the conquest of disease? They were individual genius, enlightened government and advancing economic conditions. It was individual genius that gave us smallpox vaccination, diphtheria antitoxin; it was enlightened government that enforced pasteurization, communal hygiene and sanitation; it was an advance in economic conditions that gave us a multitude of instruments with which to fight disease, and which indirectly helped to alter, to modify and to improve our mode of living. The growth of cities made safe water supplies an essential and compelled us to handle human waste effectively. Growing industry supplied us with meats and breads, with fish and fruits which are free from contamination and devoid of noxious agents. So much, so good.

But now, being largely freed from typhoid, from cholera, from yellow fever, from smallpox, etc., we must turn to the medical ills of today. Those that are outstanding include cancer, heart disease and the pneumonias, diseases of the kidneys and tuberculosis. These are the leading causes of mortality, and to these of course must be added psychopathies—those illnesses of the mind and spirit which, though not so important as a cause of death, are of the utmost importance to the community, affecting as they do so large a percentage of the population, and laying so heavy a burden, financial and otherwise, upon the rest of the community.

Facing these problems, can we then hope that individual genius, enlightened government, advancing economic conditions will achieve as much now as they did formerly? There is ever room and need in the world for the contributions of individual genius, of enlightened government and of improved economic conditions. But the effectiveness of these forces follows what, in the economic world, is called the law of diminishing returns. Those diseases which could be eradicated and controlled through discoveries by genius, followed by the legislation of enlightened government and by improved economic conditions have already largely been so affected.

It is now difficult to realize that we cannot expect a Jenner to give us an effective vaccine for every pathologic entity; that not every disease condition can be controlled by legislation; that not every disease may be overcome by better housing, better workshop sanitation and by a more liberal supply of food, clothing, shelter, recreation, etc. Who could give us a vaccine effective against the various psychoses? In the light of our experience with the prohibition law, who can expect enlightened government effectively to legislate what people may consume and how much?

The diseases prominent today must be attacked in a new wise and by means other than those so effectively employed against the ancient plagues. These newer means are in the nature of personal preventive medicine. Let us further define what we mean by personal preventive medicine. Essentially, there are three phases to the practice. First, there are those specific preventive measures with which we are all acquainted and which we see so effectively applied in the younger age groups: smallpox, vaccination, toxin-antitoxin or toxoid immunization, the prophylactic and curative use of vaccine, immune serums, convalescent serums and the like. These represent concrete achievements in the

field of immunology. This phase of personal preventive medicine is readily appreciated and easily understood.

There is another phase of preventive medicine which is not so widely appreciated and which is not adequately practiced by the private practitioner. This second phase represents the nonspecific measures which the physician may utilize in promoting the full development of the individual, constitutionally and functionally. By these nonspecific measures of preventive medicine, we have in mind hygienic and dietetic regimens which favor maximum growth and maximum health.

The obstetrician who supervises the daily routine of the gestating woman, thereby procuring for her a minimum of discomfort during pregnancy, and a maximum of safety in delivery, and who, by regulating the woman's diet assures the growing fetus of an adequacy of raw materials out of which it may build its body, such an obstetrician is practicing personal preventive medicine of a nonspecific type.

The pediatrician who treats the well child, who regulates its diet, who watches each step of the child's development, who periodically checks the ear, nose and throat condition, eyesight, posture and dentition; who prescribes not medicaments alone, but diet, sunlight, an antirachitic dietary and other agents; who knows enough about mental hygiene to watch the psychologic and emotional development of the child—such a physician practices personal preventive medicine of a nonspecific kind.

There remains the third division of the practice of personal preventive medicine, devoted to the retardation of already existing pathologic conditions. It is in this connection that we might recall the words of Osler to the effect that if one wishes to live long, one should develop a chronic illness and take care of it. Each of us knows from our own experience numerous cases of chronic illness, respiratory, circulatory, nephritic, etc., wherein, because the individual and his physician were impressed with the need for careful supervision of the sufferer, life and efficiency were maintained and prolonged. An illness is indeed at times a godsend to the unheeding, negligent person.

This is the framework of preventive medicine, and into this framework fits neatly and significantly the practice of oral hygiene. Oral hygiene, though cataloged a specialty in the field of dentistry, is indeed an important phase of the practice of preventive medicine. In fact, I may say that the profession of the oral hygienist is among the very first to be totally dedicated to the practice of preventive medicine.

Though perhaps a practical necessity, there is too much of a hiatus between the practice of medicine and that of dentistry. This hiatus, this gap of separation, has existed to the disadvantage of the individual. Like the artificial division of the human being into the two separate elements of body and mind, so in miniature, in the division of dentistry and medicine, we have had a separation of the individual into the realm of the teeth, the province of the dentist, and the remainder, the province of the physician. Between the two occur many sins of omission. There is no need for me to lay much stress on the interrelationship of dental disease and general health. You know that as a focus of infection, the teeth stand first in order of importance. To the foci of infection in diseased teeth are charged such debilitating, crippling and destructive conditions as arthritis, endocarditis, myocarditis, pericarditis—in fact, it has been well demonstrated that many cases of heart disease have

their origin in some apparently neglected or insignificant focal infection. The kidneys too may become involved and affected by infection arising from diseased teeth.

Furthermore, apart from the specific pathologic conditions which are traceable to infected teeth, there are the many other damages suffered from dental decay and destruction. The loss of teeth seriously cripples the chewing mechanism, the ratio of the crippling, in relation to the number of teeth lost, being geometric rather than arithmetic. A crippled masticatory instrument means a disability imposed on the digestive system. This, in turn, means interference with nutrition, and nutrition is, of course, the stoking and the firing of the human machine. Lower nutritional efficiency and you impose an all-pervading and far-reaching handicap on the individual.

Still more, there is to be considered the unhygienic, morbid, I may even say the putrid, condition that is associated with dental decay, a condition that is offensive esthetically and biologically. The esthetic side of the oral hygiene problem is not to be underestimated. Esthetics indeed, as has been recognized in modern psychology and psychiatry, forms a large part of and is a significant ingredient of human existence.

Finally, there is the economic phase, all too self-evident to need dilatation. The cost of illness, loss of time and necessary medical and dental treatment incident to dental disease would, if it could be adequately estimated, represent a staggering sum of money.

Despite the fact that all of these abovementioned facts are self-evident, so much so as to be almost elementary, comparatively little is being done in an organized way to master this problem. And there appears to be good reason for this inertia. If approached in the current matter-of-fact manner, the problem of dental health is almost insolvable and practically hopeless. With tooth decay present in from 90 to 97 per cent of our school children, with almost 100 per cent of the adult population affected by some form of oral disease, with the appalling average loss of teeth by decay and extraction, with comparatively little effective restoration, with but 25 per cent of our population receiving any systematic dental care, and 75 per cent of the population receiving little or no care, we can readily see that, in truth, the oral disease problem is insolvable by the common methods pursued thus far. Dental disease outruns dental care; the latter cannot catch up. Dental care cannot solve the problem of dental disease. The only hope lies in the prevention of dental disease.

That dental decay can be prevented is no longer subject to question. In fact, in following the literature on the subject, one sees prevention taken for granted, the only question being which are the most important factors in prevention; whether the emphasis is to be placed on oral cleanliness, or more strictly, oral hygiene, or on a balanced and adequate diet.

That oral hygiene in itself, independent and apart from alterations and improvements in the diet of the individual, can effect a reduction in the prevalence of dental caries, particularly in children, has been clearly demonstrated by the work of a number of groups, including your own Guggenheim Clinic.

That improvement in diet, particularly through the addition of foods rich in vitamin D, calcium and phosphorus, can prevent caries, has been shown by the Mellanbys of England, and by others in the United States.

That there is a good deal of controversy between these two different schools

of thought—the hygienists and the dietists—does not distress me at all. I know them both to be right. I am not distressed by the heat of their discussion because I know that, by virtue of their respective enthusiasms, both the art and the application of oral hygiene and dietetics in relation to oral health will be substantially advanced. I cannot see how anyone can fail to appreciate the value and significance of both schools of thought.

Assuredly, adequate nutrition is essential to all sound growth and development and to health. The effect of inadequate diet, and particularly the diets lacking important mineral salts and vitamins, has been experimentally demonstrated in animals, and has been witnessed in human beings, where famine, poverty and ignorance have been the master technicians.

The value of asepsis, of antisepsis and of cleanliness, as barriers to disease, has also been amply demonstrated.

Assuredly, good nutrition—good in the fullest sense of the word—should afford added resistance to dental decay.

On the other hand, oral hygiene, scrupulously applied, cannot but prove a balancing weight under those circumstances wherein nutrition is not all that it should be. The value of mouth cleanliness has been demonstrated in other ways, and uniquely by our confrère, the late S. W. A. Franken, who reported a reduction of two-thirds in the development of postoperative pneumonia at the Lenox Hill Hospital in New York in those cases which, previous to operation, were subjected to prophylactic oral hygiene treatments. This incidentally reveals an added field of application for oral hygiene.

Might not such prophylactic oral hygiene be applied to every gestating woman previous to delivery? What might be the value of regular prophylactic oral hygiene in cases of diabetes or nephritis? Nutrition and oral hygiene being so closely related, is there not an added warrant for scrupulous oral hygiene under disease conditions which deeply affect nutrition? We know, for example, that the skin of the healthy individual resists pyogenic bacteria, while that of the diabetic falls an easy victim to pus infections.

From the point of view, therefore, of effectiveness in dealing with the problem of oral and dental disease, oral hygiene is outstanding and promising. It bears an important and significant relation to preventive medicine, not only in the realm of the mouth, but also in the realm of the entire human machinery. It is, like most preventive measures, infinitely less costly than cure.

Finally, I cannot resist the temptation, despite my initial promise not to preach nor to lecture, to call your attention to the fact that you who are graduating are entering on a profession that is young. In its youth, you have the promise of achievement. It will be up to you to help in guiding its development. To me, it seems clear that the sphere of expansion lies in the acquisition by the dental hygienist of such a sound and thoroughgoing knowledge of dietetics as will enable the oral hygienist to intelligently instruct the patient on nutrition. No doubt the temptation to do this must beset every oral hygienist, but if you have pride in your profession, and an adequate sense of responsibility, you will inform yourselves before you offer counsel. Few spheres so readily lend themselves to the charlatan, the quack, the glib of tongue and the plain busybody, as nutrition and dietetics.

2 East One Hundred Third Street.

A LOWER FULL DENTURE WITH PORCELAIN ROOTS: REPORT OF A CASE

By GEORGE A. McMONAGLE, D.M.D., Roslyn, Wash.

IN JULY, 1933, a man, aged 56, came in wearing a full upper denture with a ten-tooth bridge below, the first bicuspid on the right, the second bicuspid and first molar on the left being used as abutments.

There was a history of pyorrhea alveolaris dating back for several years previous to construction of the bridge.

When seated in the chair, the patient extracted the bridge, teeth and all, stating that for the past six months, he had removed it twice daily, cleansing it well and replacing it.

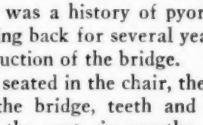


Fig. 1.—Completed denture.

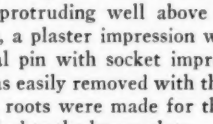


Fig. 2.—Bridge.

It took him a few minutes each time to get the bridge properly seated owing to the irregularity of the roots of the molar.

The ridge of the mandible was completely destroyed, not only from the long presence of pyorrhea, but also from irritation of the ill-fitting dummies.

As it seemed hopeless to make an ordinary lower plate that would function we attempted to use the bicuspid socket on either side for anchorage. The results exceeded all expectations.

An impression of the sockets was taken with inlay wax, into which a metal pin was inserted, protruding well above the wax. Over this, a plaster impression was taken. The metal pin with socket impression attached was easily removed with the plaster. Porcelain roots were made for the sockets and attached to the lower plate.

The patient has been wearing the plate with perfect satisfaction since Aug. 10, 1933. At no time since has be complained of any soreness from the porcelain roots.

In cases such as this, where destruction of the alveolar process has taken place to a great extent, after extraction of one or more teeth on either side the sockets can be used for anchorage if they are antiseptically packed from the time the impression is taken until the denture is finished.

PRELIMINARY TESTS OF SOME OF THE NEWER DENTURE MATERIALS*

By RONALD BARBER, D.D.S., Washington, D.C.

THE making of satisfactory artificial dentures is one of the most exacting and difficult procedures in dental practice. From the study of the anatomy of the mouth to the repairing of an artificial denture long in use, there is required an intimate and thorough knowledge of several fields, each recognized as a special problem within its own limits. Men have devoted years to the study of impression taking. Occlusion of natural and artificial teeth has been another study. Each phase of the technic of making dentures has its investigators, who are endeavoring to improve denture making. The end of these studies is not yet in sight.

The result of the work accomplished has been noteworthy. Better artificial dentures are now being made than ever before. Yet few of us are entirely satisfied with present achievements. We should like to make stronger, lighter and more natural appearing dentures which would still be durable and function more satisfactorily. So, in addition to endeavors toward improvement in technical procedures, there is the quest for more satisfactory denture materials.

In the search for a suitable material, we have in mind that it must not be injurious to the tissues of the mouth; it must be strong, durable and reasonably light in weight; it must be readily adaptable to porcelain teeth and must hold them securely; it must not warp, shrink or change shape; it must not have an offensive taste or odor; it should be pleasing in appearance; it should be a good thermal conductor; it should have a dense, hard surface; the technic of working the material must not be so intricate nor require such extensive equipment as to make the cost of the denture prohibitive, and the material should be such that a broken or used denture can be repaired or rebased should this be necessary.

The properties enumerated as desirable for a satisfactory denture are usually generalities. There is need for more specific data. Among the investigators of denture materials who have reported their results in a somewhat more definite form is John Engström, dentist, of Avesta, Sweden, who, while visiting the National Bureau of Standards in February, 1934, left translations of two articles[1] which it is understood were published in Sweden.

As yet, standards have not been set up for denture materials as has been done with many other dental materials. For example, we now demand that a dental amalgam shall have a setting expansion within definite limits and that the resistance to flow shall meet a definite stand-

*Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.

*Read before the Section on Partial Denture Prosthesis at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 9, 1934.

1. Engström, John: Rubber Mixed with Aluminum as Base for Upper Dentures, Experimenting and Tests; Resovin and Rubber, Comparative Experiments.

ard. Gold alloys for dental uses must meet requirements as to tensile strength, elongation, surface hardness and fusion point. Much of this accurate knowledge of the properties of dental materials has become available as the result of the work carried on by the National Bureau of Standards and the Research Commission of the American Dental Association. Until complete, definite data can be determined for denture materials, any statements regarding their physical properties must necessarily be vague and largely comparative.

In a description of denture materials, it is not enough to state that a product is strong. Strength is relative, but it can be measured. When it can be stated, for example, that one material has a tensile strength of 6,000 pounds per square inch and another material a tensile strength of 8,000 pounds per square inch, the comparison will be definite and valuable.

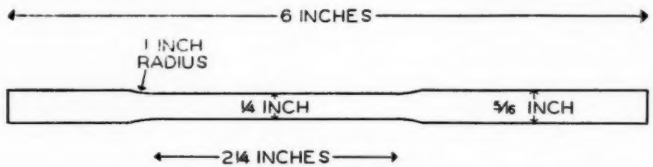


Fig. 1.—Tensile specimen.

For many years, "hard" rubber, or vulcanite, has been used extensively as a material in making artificial dentures. Rubber has many good qualities for the purpose, but is far from meeting all the requirements for a perfect denture material. Therefore, in recent years, the market has been flooded with materials intended as substitutes for vulcanite. Many of them have proved to be decidedly inferior to vulcanite in one or more essential properties and have therefore failed in practical use. In consequence, patients and practitioners have been put to extra expense and have suffered disappointment and embarrassment. This could have been prevented if there had been standards for denture materials and the new materials had been rated against those standards before being tried in practical cases. Experimentation which should have been made in the manufacturer's laboratory has too often been made in the dental laboratory at the expense of practitioner or patient.

This report gives data from an investigation of certain physical properties of several denture materials. Each of the many materials on the market is advertised as having very good qualities. It would require many months in the testing laboratory to obtain values for the physical properties of all these materials. It was decided, therefore, in this preliminary study, to select a representative thermoplastic synthetic resin and a representative thermocuring synthetic resin and conduct some laboratory tests of their properties. Similar tests and additional tests should be conducted for all such materials before they are offered for sale to the profession.

As many practitioners will wish to know how the newer materials compare with vulcanite, a typical maroon rubber and an olive base rubber were chosen for comparative tests. These materials are designated in this report as: olive base rubber A, maroon rubber B, vinyl resin C (thermoplastic) and phenol-formaldehyde resin D (thermocuring).

The materials for testing were obtained on the retail market or from a

wholesale distributor who sold them as of the same quality as supplied to the profession.

The preparation of specimens suitable for tests presented difficulties. It was not possible with ordinary dental equipment to make specimens of the shape and size necessary for use in the regular testing machines. Also, it appeared difficult to control temperatures with the precision required for accurate experimental purposes in using ordinary dental equipment. Accordingly, special molds were made which would permit making several specimens of suitable size at one time. The dimensions of the tensile specimens were thick, was placed between the aluminum blocks and the mold, below and above, as shown in Figure 2.

Impact test specimens were made in a chromium plated sectional steel mold with spaces for ten specimens. The same aluminum blocks and sheets of aluminum were used as with the mold for tensile specimens. (Fig. 3.)

Curing or pressing the materials was done in a steam-heated hydraulic vulcanizing press, the mold being placed between two steam-heated platens. It was possible to maintain a desired mold temperature within one degree centigrade. (Figs. 4 and 5.)

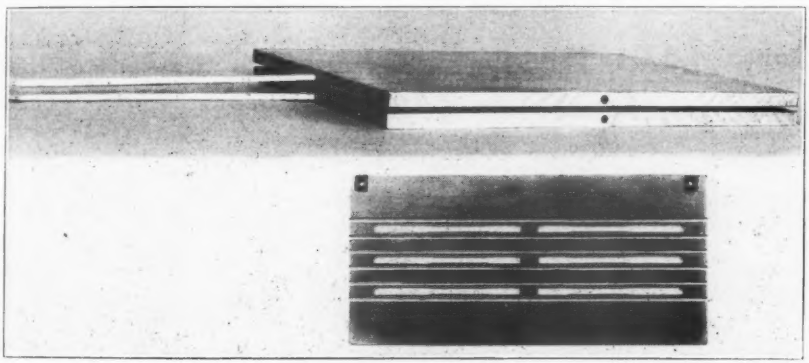


Fig. 2.—Above: Mold between aluminum blocks with thermometers. Below: Mold for tensile specimens.

6 by $\frac{5}{16}$ by $\frac{1}{8}$ inch with a reduced section $2\frac{1}{4}$ by $\frac{1}{4}$ by $\frac{1}{8}$ inch, the curve at the reduction having a radius of 1 inch. (Fig. 1.)

The mold used in making the tensile specimens was made of steel, chromium plated, the overall dimensions being 7 by 14 by $\frac{1}{8}$ inch, with six slots or frames. Two blocks of aluminum, 12 by 16 by $\frac{1}{2}$ inch, with holes drilled in the ends and sides for insertion of thermometers, were used as the bottom and top for the mold. A sheet of aluminum, 0.01 inch

Two thermometers, one in the aluminum block above the mold and one in the block below, were used to determine temperatures. After the mold had been warmed to initial pressing or curing temperatures, the two thermometers agreed within one-half degree centigrade. A comparison of the thermometer readings with the temperature at the center of the mold was made in one of the actual pressing operations. This was done by placing a thermocouple junction approximately at the center of the mold, the wires lead-

ing out through a waste channel of the mold. Readings taken by means of a portable potentiometer indicated that the temperatures at the center of the mold agreed with the thermometer readings within the experimental error. Since the directions for curing or pressing the various materials permit a spread of several degrees, and since it was possible to stay well within the permitted ranges, the thermometer readings were considered sufficiently close and were used throughout when making specimens.

It should be remarked that the ordinary dental vulcanizer thermometer seldom, if ever, indicates the true temperature of the vulcanizing chamber. The bulb of the thermometer, being set in a mercury well in the vulcanizer top, indicates only the temperature of the vulcanizer top. The steam gage is a more accurate indicator of the temperature within the vulcanizing chamber. By using a calibrated steam gage on one of the ordinary dental vulcanizers, it was found that the pressure indicated a temperature in the chamber as high as 320 F. when the vulcanizer thermometer indicated 300 F. Thus, in vulcanizing a case with the usual dental equipment, if the thermometer indicates 300 F., the actual vulcanizing temperature may be as high as 320 F. This discrepancy has been pointed out from time to time, but is likely to be forgotten.

A series of test vulcanizations using a dental vulcanizer equipped with a calibrated steam gage showed that an actual temperature of 320 F. for three hours was necessary to get good results with maroon rubber B. Specimens for the physical tests were made from maroon rubber B in the hydraulic press vulcanizer by raising the temperature of the mold from 212 to 320 F. in thirty-five minutes, holding at 320 F. for three hours and then cooling to room temperature in approximately thirty minutes. It should be remembered, in connection with the maximum temperature stated, that it is approximately the same as the temperature attained in a dental vulcanizer, even though the temperature indicated by the usual vulcanizer thermometer may be as much as 20 degrees lower, as explained above.

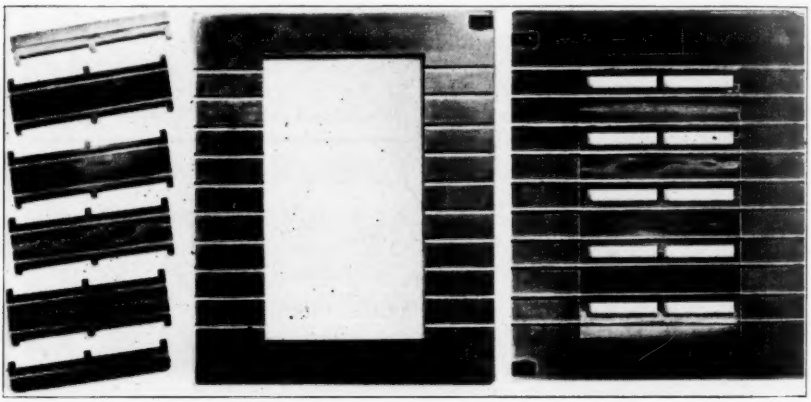


Fig. 3.—Mold for impact specimens: Left, mold parts; right, mold assembled.

The presence of inert material in the form of coloring matter and filler in rub-

ber makes it easier to get a good result in vulcanization. The nearer the mixture is to a combination of rubber and sulphur, the greater the possibility of separation of the rubber and sulphur or the rapid evolution of hydrogen sulphide gas and resultant porosity. When a mixture of rubber and sulphur is heated, a chemical reaction is started between the two constituents which, in turn, causes a liberation of heat. This additional heat increases the chemical reaction, which may become so violent that there is a rapid formation of gas and, as a consequence, the rubber is filled with bubbles. This can be prevented by raising the temperature slowly and keeping the rubber under pressure.

Colored rubbers, such as maroon rubber B, may contain close to 50 per cent of coloring matter and filler. These materials, distributed through the rubber, cause the vulcanization process to proceed more evenly and with less violence of reaction. The addition of a considerable proportion of coloring matter and filler seems to reduce the strength and elasticity of dental vulcanite. The manufacturer has kindly furnished the formula for the batch of maroon rubber from

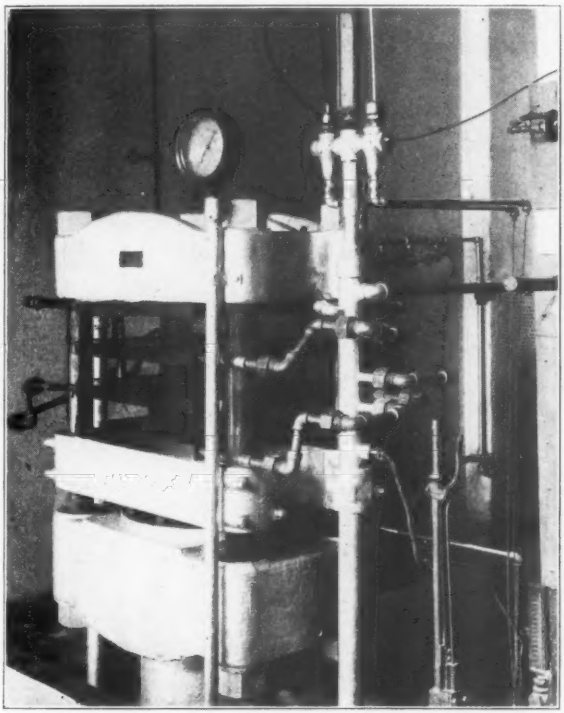


Fig. 4.—Hydraulic vulcanizing press.

which test specimens were made. The formula is as follows:

Rubber (crepe)	35.0 per cent
Sulphur	16.6 per cent
Pigment and filler	47.9 per cent
Magnesia (accelerator)	0.5 per cent
	100.0 per cent

The manufacturer has stated that he is now using a different formula for his maroon rubber.

Olive base rubber A contains a much smaller proportion of inert material than maroon rubber B. The manufacturer has furnished the formula, as follows:

Raw rubber	62 per cent
Sulphur	29 per cent
Inert material	9 per cent
Accelerator	none
	100 per cent

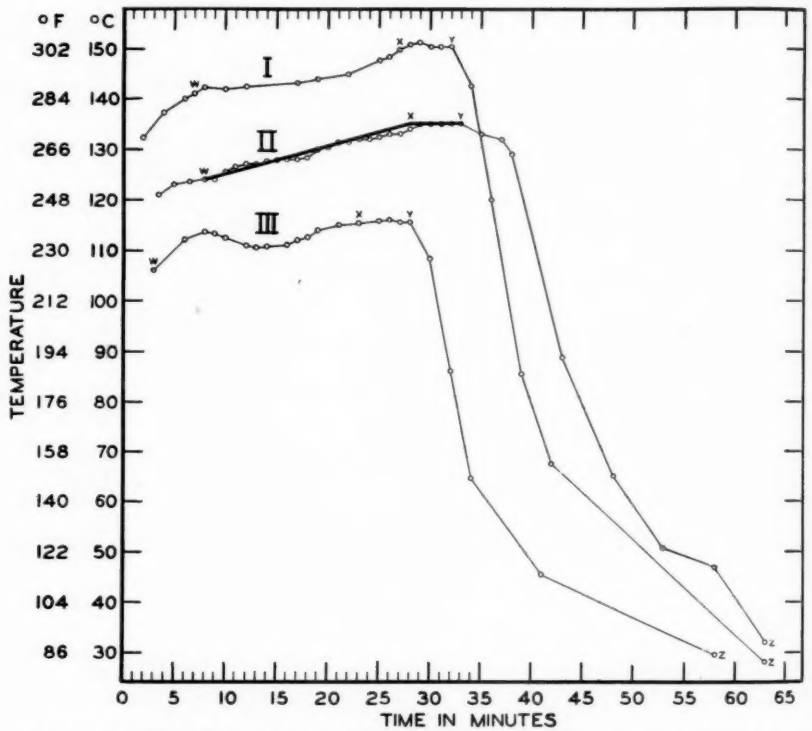


Fig. 5.—Temperature-time plots, pressing vinyl resin C. *I*, specimens purposely pressed above the normal temperature range. *II*, normal pressing. The heavy line indicates the author's interpretation of the instructions supplied with the material. *III*, specimens purposely pressed below the normal temperature range. Zero of the time axis indicates the time the filled mold was placed in the press; *W*, the time light pressure on the mold was started; *X*, the time heavy pressure on the mold was started; *Y*, the time the heat was shut off and chilling of the mold started; *Z*, the time the mold was removed from the press.

The proportions of rubber and sulphur in the two compounds are approximately the same as the theoretical proportion in

which they combine, that is, 68 parts rubber to 32 parts sulphur. The olive base rubber A requires different curing or vulcanization from that for maroon rubber to get good results. In making specimens of olive base rubber A, the mold was heated from 212 to 320 F. in fifty-five minutes, then held at the latter temperature for three hours, in the case

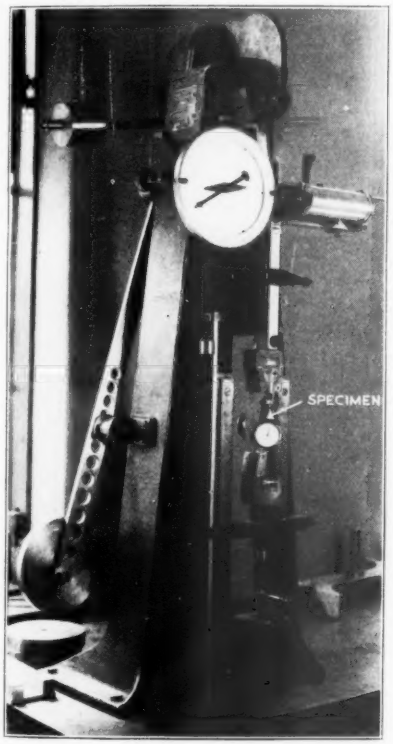


Fig. 6.—Amsler testing machine.

of tensile specimens, and three hours and thirty minutes in the case of the thicker impact specimens. Cooling to room temperature was done in approximately thirty minutes.

Vinyl resin C specimens were made by pressing at a temperature range which followed closely that set forth in the directions supplied by the wholesale distributor of the material. In addition to those specimens made at the normal temperature range, two sets of tensile specimens were made, to observe, if possible, whether deviation from the normal temperature range for pressing affected the tensile properties. One set of specimens was pressed at a range of 25 to 30 degrees Fahrenheit above the normal

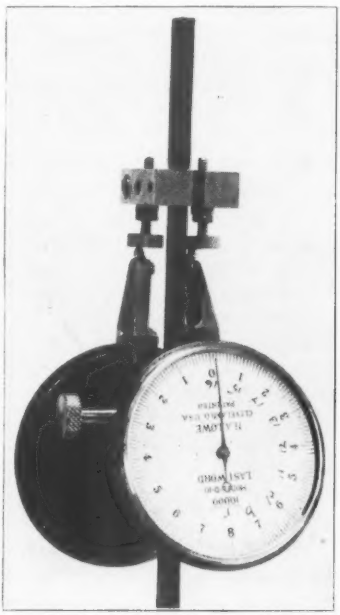


Fig. 7.—Extensometer mounted on specimen.

temperature range. These specimens were scorched to a caramel color. Another set of specimens was pressed at a range 25 to 30 degrees Fahrenheit below the normal range. Three temperature-time plots for pressing vinyl resin C are shown in Figure 5. Number II is an example of what was considered a normal

pressing. The heavy line indicates my interpretation of the instructions issued by the wholesale distributor of the material. Number I is the plot for the pressing of specimens which were purposely subjected to higher than normal temperatures. Number III is the plot for the pressing which was purposely done below the normal temperature range. The zero of the time axis indicates the time at which the filled mold was placed in the press. Light pressure on the mold was started at *W*. Heavy pressure was put on the mold at *X*. The heat was shut off and chilling of the mold started at *Y* and the cold mold removed from the press at *Z*.

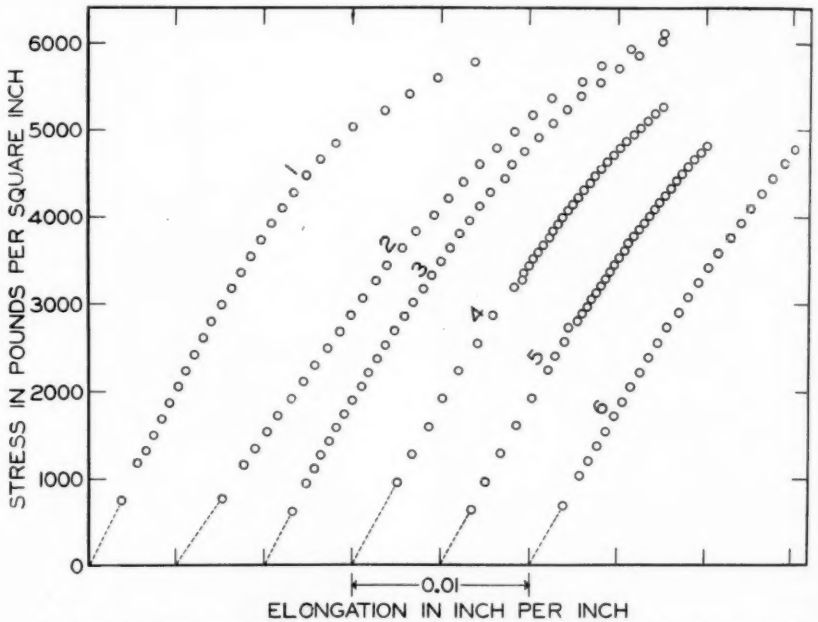


Fig. 8.—Representative stress-strain curves of four denture materials. *1*, maroon rubber B; *2*, olive base rubber A; *3*, vinyl resin C, normal pressing; *4*, vinyl resin C, pressed below normal temperature range; *5*, vinyl resin C, pressed above normal temperature range; *6*, phenol-formaldehyde resin D.

The specimens of phenol-formaldehyde resin D were cured at a temperature slightly below that recommended in the instructions of the wholesale distributor of the material and for a few minutes less time. The temperature of the filled mold was raised from 130 to 212 F. and the mold completely closed in fifteen minutes. The temperature was then carried to 262 F. in twenty minutes and the mold maintained at that temperature for two hours and twenty-five minutes. Then the heat was shut off and chilling of the mold started and, in about thirty minutes, the cold mold was removed from the press. Earlier tests showed that specimens were likely to be overcured if held as high as 266 F. in the steel mold for as long a time as stated in the directions.

Possibly, this was because the thermal conductivity of the steel mold was greater than that of the usual plaster mold in a bronze flask.

Specimens of all materials were kept at room temperature, except as noted hereafter, between the time they were cured or pressed and the time they were tested. Except as noted hereafter, all tests were made on the third day after the specimens were cured or pressed.

Fig. 9.—Schopper impact machine.

TENSILE TESTS

An Amsler testing machine and an averaging extensometer were used to obtain measurements of stress and elongation. The indicated loading of the machine was done at the rate of 10 pounds a minute. The extensometer used was of the type employed in previous work on gold alloys and wires by Taylor, Paffenbarger and Sweeney[2] and consists of two "last word" indicator dials which are clamped to the gage length of the specimen. Another clamp is attached to the specimen in such a way that it is in contact with the fingers of the indicators. The dials are graduated to 0.0001 inch. The two dials, placed on opposite sides of the specimen, enable the operator to secure the average strains set up in the specimen. (Figs. 6 and 7.)

STRESS-STRAIN CURVES

There appears to have been little published regarding the stress-strain behavior of these denture materials. Gottlob[3] stated that the tensile test curve of ebonite (hard rubber) was similar to that of metals, but he did not mention which metals. Davies[4] published stress-strain curves for hard rubber prepared and tested in a number of different ways. The curves shown in his Figure 2 are of particular interest.

The object in obtaining a stress-strain curve in studying the physical properties of a material is that it affords information regarding the elongation of the material at various stresses, and, as we shall see later, offers a visual representation of the behavior of the material when subjected to stresses. Representative stress-

2. Taylor, N. O., Paffenbarger, G. C. and Sweeney, W. T.: Study of Wrought Gold Alloys: Preliminary Report, J.A.D.A., 19:410-415 (March) 1932.

3. Gottlob, Kurt: Technology of Rubber (trans. by Rosenbaum, J. L.) London: MacClaren & Sons, Ltd., 1926, p. 303.

4. Davies, B. L.: Stress-Strain Relationship in Ebonite, Tr. Inst. Rubber Indus., 9:130-149 (Aug.) 1933.

strain curves for the four denture materials included in this report are shown in Figure 8.

PROPORTIONAL LIMIT

Proportional limit, which can be obtained from the stress-strain curve, is defined, in tensile tests, as the stress at which elongation ceases to be proportional to the load. None of the four denture materials showed as definite a proportional limit as do many metals. For the purpose of this paper, the proportional limit was arbitrarily designated as the point at which an equal increment of load produced an elongation one and one-quarter times the elongation produced by similar increments of load at lower stresses. The results are satisfactory for a comparative rating of the four materials studied. In most instances, the average elongation produced by 5 pound increments of load between 30 and 80 pounds on the machine was used as the standard value. The results are given in Table 1.

MODULUS OF ELASTICITY

The modulus of elasticity is defined as the ratio between the stress or load in pounds per square inch, for stresses below the proportional limit, and the strain or elongation in inch per inch. The modulus of elasticity is an indication of the ability of the material to resist distortion when subjected to moderate stresses. For each of the materials, the modulus of elasticity was obtained on the portion of the stress-strain curve from a

TABLE 1.—RESULTS OF TENSILE TESTS OF FOUR DENTURE MATERIALS

Material	Proportional Limit			Ultimate Tensile Strength		
	Number of Specimens	Lbs./Sq. In. Range	Average	Number of Specimens	Lbs./Sq. In. Range	Average
Olive base rubber A	4	3,700 to 4,100	3,900	4	7,000 to 7,200	7,100
Maroon rubber B	5	2,900 to 4,000	3,500	10	5,600 to 7,000	6,100
Vinyl resin C, pressed at normal heat	6	3,400 to 3,900	3,700	11	7,100 to 7,700	7,300
Vinyl resin C, pressed at low heat	5	3,800 to 4,300	4,100	5	8,000 to 8,200	8,100
Vinyl resin C, pressed at high heat	4	3,600 to 4,100	3,800	4	6,500 to 8,000	7,300
Phenol-formaldehyde resin D	3	3,500 to 4,100	3,800	5	5,100 to 6,400	5,600

Material	Modulus of Elasticity			Percentage of Elongation		
	Number of Specimens	Lbs./Sq.In. Range	Average	Number of Specimens	Range	Average
Olive base rubber A	4	270,000 to 290,000	280,000	4	1.3 to 2.0	1.6
Maroon rubber B	4	370,000 to 430,000	410,000	5	0.2 to 0.7	0.4
Vinyl resin C, pressed at normal heat	4	320,000 to 350,000	330,000	6	0.3 to 4.7	2.0
Vinyl resin C, pressed at low heat	3	310,000 to 340,000	330,000	5	1.0 to 22.0	11.0
Vinyl resin C, pressed at high heat	4	290,000 to 370,000	330,000	4	1.2 to 10.0	3.5
Phenol-formaldehyde resin D	3	300,000 to 330,000	320,000	4	0.1 to 0.5	0.3

point well above the initial observations, usually at about 1,200 pounds per square inch, to a point approximately 500 pounds per square inch below the proportional limit. This enables one to use the best part of the curve to determine the modulus. The modulus of elasticity was computed by dividing the increase in stress by the increase in strain or elongation. The results given in Table 1 were computed as the average value from a number of curves for each material. Proportional limits and moduli of elasticity were not determined for all specimens.

PLASTIC ELONGATION

Elongation (or deformation) of a material is of two kinds, elastic and plastic. Elastic deformation refers to the change in dimensions which takes place when the material is subjected to stress (stretching, in the case of tension) and which disappears when the stress is removed. That is, the material tends to return to its original dimensions. An example is the stretching of a rubber band. Plastic deformation refers to the permanent change in dimensions produced by stress. The material does not completely return to its original dimensions when the stress is removed. Examples of this are the permanent distortion resulting from pulling or bending a piece of soft wax or 24-karat gold. When a material which has a relatively high permanent elongation is subjected to stress, it is easily distorted and loses its original shape. On the contrary, a material showing relatively little permanent elongation when subjected to stress is not so easily distorted and may be expected to return more nearly to its original shape.

Permanent elongation, or plastic deformation, of the denture materials was determined by putting the tensile specimens in a 2-inch gage block and marking them before they were tested. After the specimens were broken, the pieces were assembled in the same gage block and the change in length measured by means of a micrometer microscope. Because of the obvious difficulty in fitting the broken ends exactly, there was bound to be some error in the results.

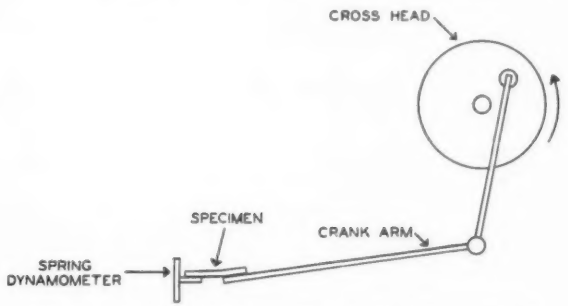


Fig. 10.—Flexural fatigue machine shown diagrammatically.

The elongation of the different materials and, in some instances, specimens of the same material, varied considerably. The olive base rubber A showed a slight but definite tendency toward "necking down" or to have a noticeable reduction of cross-section at and near the break. The maroon rubber B specimens broke sharply, with no visible necking down.

The vinyl resin C specimens, pressed at a normal temperature range, varied in their behavior. One third of the specimens showed a slight necking down. The others broke sharply with a tendency toward a v-shaped break, that is, a small triangular piece of material came away at the break. The vinyl resin C specimens, purposely pressed below the normal temperature range, showed, with one exception, a marked tendency to neck down and stretch out. These specimens, made from the same batch of material, pressed at the same time in the same mold and tested within an hour or two of one another, showed a great variation in elongation. Vinyl resin C specimens, purposely pressed at a higher than normal temperature range, also varied in their behavior, but in the other way. Most of the specimens broke sharply, with a tendency toward a v-shaped break, and only one specimen showed definite necking down. The phenol-formaldehyde resin D specimens showed no necking down, all breaking sharply, mostly with a v-shaped break. The percentages of elongation are given in Table 1.

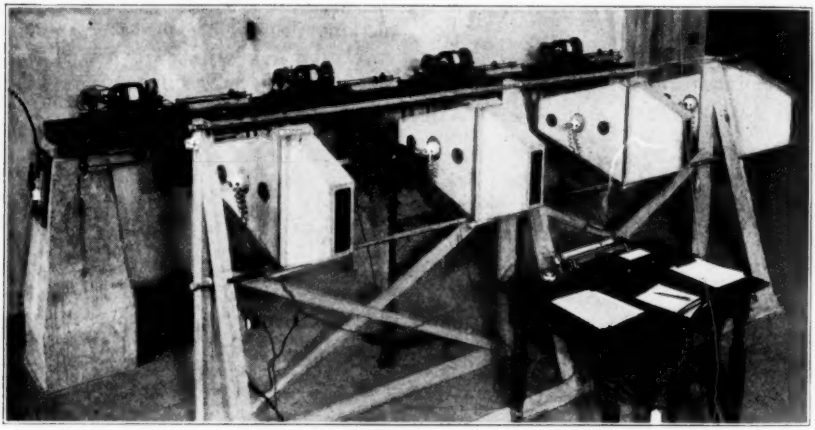


Fig. 11.—Battery of flexural fatigue machines with optical apparatus.

ULTIMATE TENSILE STRENGTH

The ultimate tensile strength was obtained by continuing the loading of the specimen after removal of the extensometer, the rate of loading being the same as before, namely, 10 pounds on the machine each minute, until rupture occurred. The maximum loads recorded are given in pounds per square inch, to the nearest hundred pounds, in Table 1.

IMPACT TEST

Impact tests were made on specimens milled to the dimensions 0.5 by 1.0 by 6.0 cm., those being the dimensions specified for the smaller of the two sizes of specimens for which the Schopper (Charpy type) impact machine is designed. The 40 cm. kg. hammer was used. The specimens were placed on the horizontal supports in such manner that the smallest dimension (0.5 cm.) lay in the direction of the hammer blow. (Fig. 9.) The specimens were kept at room

temperature for three days, after pressing or curing, before testing, with the exception of one set of vinyl resin C specimens. The latter were placed in artificial saliva[5] and kept in an oven at 37 C. (98.6 F.) for twenty-six days before testing.

The hammer failed to break one of the olive base rubber A specimens; which indicated an impact value in excess of 40.0 cm. kg. (2.87 foot pounds). The values for the other specimens of olive base rubber A, which were broken, ranged from 14.0 cm. kg. (1.02 foot pounds) to 32.0 cm. kg. (2.31 foot pounds). (Table 2.) All of the maroon rubber B specimens were broken by the hammer. Values are given in Table 2.

Table 2.—Impact Test

Material	Range From Cm. Kg.	Range To Cm. Kg.	Average Cm. Kg.
Olive base rubber A	14.0	Over 40.0	Not all broken
Maroon rubber B	3.9	15.8	7.6
Vinyl resin C	12.7	Over 40.0	Not all broken
Phenol-formaldehyde resin D	1.6	4.8	3.3

None of the vinyl resin C specimens which had been pressed from a single piece of material was broken when struck by the hammer; which indicated an impact value in excess of 40.0 cm. kg. (2.87 foot pounds) for those specimens. Certain specimens had been made by fitting two pieces of material, end to end, in the mold. Those pieces of material seemed, from outward appearances after pressing, to have united and formed good specimens. All such specimens made from pieced material were broken when struck by the hammer, the impact values ranging from 12.7 cm. kg. (0.92 foot pounds) to 23.7 cm. kg. (1.71 foot pounds). It therefore appears that pieces of material of vinyl resin C do not unite, in pressing, to form a union which renders the fused pieces as strong as the continuous material itself. No appreciable difference was noted between specimens 3 days old and those kept in artificial saliva for twenty-six days. All the specimens of phenol-formaldehyde resin D were broken by the hammer. The values are given in Table 2.

Surface Hardness

Tests of surface hardness were made with the Vickers machine using a load of 10 kg. on a diamond pyramid for a duration of ten seconds. The values are given in Table 3. These values can be considered only tentative and comparative. Some of the denture materials appeared to flow under a load and, before true values can be obtained, it will be necessary to determine the influence of time of loading and flow, as has been done by McBurney.[6]

Coefficient of Thermal Expansion

The coefficient of thermal expansion of a denture material may be of importance. If it is high and the thermal dif-

5. Sodium chloride, (NaCl), 0.036 gm.; potassium chloride, (KCl), 0.153 gm.; calcium chloride (anhydrous), ($CaCl_2$ anhydr.), 0.056 gm.; disodium phosphate, ($Na_2HPO_4$12 H_2O), 0.210 gm.; water, (H_2O), to 2.0 liters.

6. McBurney, J. W.: Indentation of Asphalt Tile, preprint 81, to be published in Proc. Am. Soc. Testing Materials.

fusivity is low, thermal stresses which exceed the breaking strength of the material may be produced by sudden sharp changes of temperature, with cracking or fracture as a result. As is well known, a thick piece of ordinary glass is likely to break if subjected to a sudden sharp change of temperature.

TABLE 3.—SURFACE HARDNESS

Material	Vickers Number
Olive base rubber A	15.6
Maroon rubber B	17.5
Vinyl resin C	15.1
Phenol-formaldehyde resin D	24.5

on the upper end of the specimen. One junction of a thermocouple was placed in the tube near the center of the specimen and the temperatures determined by means of a potentiometer. In one of the tests the fused quartz tube was placed in a mixture of ice and salt. In the other tests, the fused quartz tube was placed in a specially constructed furnace.

COOLING CURVE

A cooling curve was determined (temperature versus time) between 160 and 30 C. on a sample of newly received vinyl resin C material, in order to determine whether this material has a transformation or change in structure in this temperature range. The curve obtained is regular and therefore indicates that this vinyl resin has no critical region between 30 and 160 C.

TABLE 4.—AVERAGE COEFFICIENTS OF LINEAR EXPANSION OF THREE DENTURE MATERIALS

Material	Temperature Range C	Average Coefficient of Expansion per Degrees C	Remarks
Maroon rubber B	25 to 55	0.000056	Specimen started to bend or shrink at about 58 C.
Vinyl resin C			
Spec. 1	−20 to +25	0.000062	
Spec. 2	+25 to 60	0.000071	Specimen started to bend or shrink at about 61 C.
Phenol-formaldehyde resin D	25 to 43	0.000079	Specimen started to bend or shrink at about 45 C.

The coefficients of linear thermal expansion of three of the denture materials were determined by a method used by Hidnert and Sweeney.[7] The specimens used had been kept at room temperature for three days or longer after pressing or curing. A specimen 5 inches long was placed vertically in a fused quartz tube closed at one end. A fused quartz rod was inserted in the tube so that it rested

FLEXURAL FATIGUE TESTS

Since artificial dentures are subjected to flexures or bends during mastication, and since failures of dentures apparently could not be explained from the data available, it was thought necessary to extend the work to include flexural fatigue tests. In such tests, the specimens were

7. Hidnert, Peter, and Sweeney, W. T.: Thermal Expansion of Magnesium and Some of Its Alloys, paper No. 29, Bur. Stan. J. Res., November, 1928.

TABLE 5.—FLEXURAL FATIGUE TESTS OF FOUR DENTURE MATERIALS*

Material	Source of Specimen	Maximum Fiber Stress Lbs./Sq.In.	Number of Cycles	Remarks
Olive base rubber A				
Specimen I 8a	Impact	3,487	1,217,600	Did not break
Specimen I 10a	Impact	4,206	6,300,400	Did not break
Specimen I 7	Impact	3,821	3,385,900	Did not break
Specimen I 9	Impact	4,910	696,200	Broke (at crank end)
Specimen I 8b	Impact	4,791	3,467,500	Broke (at crank end)
Specimen I 10b	Impact	4,584	635,200	Broke (at crank end)
Specimen N 1	New	5,644	54,700	Broke (at spring end)
Specimen N 3	New	5,608	376,800	Broke (free length)
Specimen N 4	New	5,025	2,531,700	Broke (free length)
Specimen N 2	New	4,540	2,145,800	Broke (free length)
Maroon rubber B				
Specimen I 4	Impact	2,975	6,087,200	Did not break
Specimen I 2	Impact	3,740	1,806,900	Broke (free length)
Specimen I 7	Impact	3,471	5,077,900	Broke (free length)
Specimen I 6	Impact	4,960	1,000	Broke (at crank end)
Specimen N 1	New	3,740	1,751,200	Broke (free length)
Vinyl resin C				
Specimen N 3	New	3,623	5,000	Broke (free length)
Specimen N 2	New	3,623	14,400	Removed badly cracked for x-ray examination
Specimen N 5	New	1,962	123,200	Broke (free length)
Specimen N 1	New	1,334	57,800	Broke (free length)
Specimen I 3a	Impact	1,093	1,215,200	Broke (at crank end)
Specimen I 3b	Impact	1,002	617,900	Broke (at crank end)
Phenol-formaldehyde resin D				
Specimen I 7	Impact	2,520	6,531,300	Did not break
Specimen I 6	Impact	3,350	293,400	Broke (at crank end)
Specimen I 4	Impact	3,124	653,000	Broke (at crank end)
Specimen I 2	Impact	3,075	6,851,000	Did not break
Specimen I 3	Impact	3,365	3,871,100	Did not break
Specimen I 5a	Impact	3,710	350,300	Broke (at crank end)
Specimen N 7a	New	5,222	10,400	Broke (free length)
Specimen N 7b	New	4,330	102,900	Broke (free length)
Specimen N 3a	New	3,610	252,100	Broke (at crank end)
Specimen N 3b	New	3,452	215,200	Broke (free length)

*Where specimens with a constant cross-section are gripped in a testing machine, it is desirable to note the location of the fracture even where the clamping stresses are graduated (as in the machines used in the tests described above) by leather inserts between the clamps and the specimen. The impact specimens were all placed in the machines so that the impact fracture was at the crank end. The relatively large number of failures at that end suggests some change in the properties of the material.

flexed a definite amount and observations taken on the number of times the materials withstood these flexures without fracture.

The specimens tested were milled to 0.5 cm. thick by 1.0 cm. wide in cross-section. The specimens were bent on the minor dimension so that the wide sides

of the specimens were subjected to the maximum fiber stress. Equal tensile and compressive stresses were alternately applied to each side of the specimen. The specimens had been kept at room temperature for a minimum of three days after curing or pressing. In order to expedite the tests, some specimens were obtained from the ends of impact specimens. These have also been included in the table.

The flexural fatigue tests were made in machines which are shown in Figure 10 (diagrammatically) and in Figure 11. One end of the specimen was clamped to a previously calibrated spring dynamometer and the opposite end was clamped to an eccentrically attached crank arm, which was actuated by a cross-head attached to a motor. The magnitude of these stresses was measured by optical methods, as shown in Figure 11. Any tendency of the specimen to weaken, crack or fail to withstand the applied stress was instantly portrayed by a mirror attached to the spring dynamometer, which reflected a spot of light indicating the amount of fiber stress applied to the specimen.

With such stress measuring devices attached to the spring dynamometers, it was possible to know definitely that the extreme fiber stresses were maintained within reasonable limits during the test. For some of the materials, it was found that because of the flow of the material under the clamps, the machines had to be adjusted from time to time during the tests. It is thought that only through the use of properly indicating machines of this type can reasonably constant stress conditions be maintained. The stress applications were made at a rate approximately 1,000 a minute. The machines operated in the open laboratory at usual July temperatures.

There were no data available on these materials to guide one in selecting the fiber stresses which should be used. As a first approximation (based on the behavior of certain metals), it was decided to use stresses equal to about 50 per cent of the ultimate tensile strength of the respective denture material, and then, guided by the results, make further tests at fiber stresses above or below the first selection. Then, the resistance of the various materials to flexural fatigue could be correctly related. The results are given in Table 5.

ROENTGEN-RAY EXAMINATION

Attempts at detecting the cause of the early failures of vinyl resin C specimens were made by a roentgen-ray study of specimens before and after flexure tests. The roentgen-ray patterns are not conclusive and do not justify a positive statement regarding a possible tendency of vinyl resin C to crystallize during flexures. Time did not permit an extension of this attempt to discover the cause of failure.

COMMENTS

In some instances, the values given for a physical property of a number of specimens are not so consistent as would be the case for a metal or an alloy. This is to be expected in the study of such organic substances as these denture materials. For the present, it is not essential that the values be determined to extreme degrees of exactness. The purpose of this paper will be fulfilled if it brings attention to the practical possibility of a thorough, complete study of all denture materials and the establishment of minimum standards. Then, a new material should be required to meet those standards before it is accepted. No attempt at writing a specification will be made at this time. One may rate substitutes for vulcanite against the data given for vulcanite and predict with a fair accu-

racy the type of service to be expected from the qualities obtained in this research.

A number of properties were not studied. Thermal conductivity, specific gravity, porosity, original color and color duration, tolerance by tissues of the mouth, resistance to staining and resistance to oral fluids and food constituents should be investigated. The ease of technic in making practical cases should be given a rating. It is essential that the entire field of denture materials be made the subject of a thorough investigation. The experience gained thus far indicates plainly that a complete study of denture materials must necessarily be a large undertaking, a work of several years for a suitably equipped group of investigators.

SUMMARY

1. Two dental rubbers and two well-advertised substitutes for vulcanite were carefully processed and tested for certain physical properties, the data obtained giving opportunity for comparing vulcanite and these substitutes.

2. The values for proportional limit, ultimate tensile strength, modulus of elasticity and possibly surface hardness show no marked differences in the materials.

3. The impact tests show definite differences and indicate that a material having lower numerical values may be expected to display brittleness. This prediction is further enhanced by the low values for percentage elongation.

4. The expansivity values indicate no definite superiority of one material over the other.

5. The flexural fatigue tests revealed decided defects for one material.

6. No specifications are set up for denture materials, but test methods and comparative values are now available for many of the properties essential in satisfactory dentures.

7. The research should be extended to cover the entire field of properties and a specification should be prepared at an early date. The saving to the profession and the public which could be made by transferring the experimentation from the hands of the practitioner to the research laboratory would be enormous.

(The author is indebted to the National Bureau of Standards for placing at his disposal equipment and assistance to carry out the research. Some of the instruments employed in the work represent years of effort and research in construction and standardization.)

(The statements set forth in the foregoing article are the opinions of the author and are not to be taken as expressing the views of the Navy Department or the Naval service.—U. S. Navy Regulations.)

DENTAL AND MEDICAL PRACTICE*

By ERNEST E. IRONS, M.D., Chicago, Ill.

THE practice of dentistry and the practice of medicine have been growing steadily closer together as experience has demonstrated the interrelation of their problems. Disorders of the digestive system not infrequently arise through the loss of masticatory function and, in many instances, are relieved by the installation of artificial dentures. The dentist and the physician meet on common ground in the study of the alterations of the tissues of the mouth. Inflammation of the gingival margins, and the loss of epithelium of the tongue and lips in pernicious anemia; herpetic lesions of the mouth associated with general infections and colds; disturbances of the mucosa of the mouth which result from hyperchlorhydria, and Vincent's infection of the gums and mouth, studied and successfully treated many years ago by our own Dr. Gilmer, are examples of the close interrelation of problems of the mouth and those of general disease.

The illnesses of the first four years of life, especially those of the first two years, as well as the problems of diet and nutrition in these same years of childhood, add a large factor to that of heredity in determining what dental problems associated with defects of the enamel and dentin will arise during the remainder of life. The problems of the oral surgeon are partly dental and partly medical, and he must have a knowledge of both professions.

Even in the field of orthodontia, a first hand knowledge of the medical problems of childhood and the experience gained by caring for diseases of children will broaden the point of view of the orthodontist and assist him in handling the medical aspects of his more strictly dental field.

Perhaps there is no development of the last thirty years, or indeed in the entire history of dentistry and medicine, which has been so effective in emphasizing the close relation of dentistry and medicine as has the concept of focal infection. In this field, Dr. Billings, Dr. Gilmer and Dr. Black, who were close friends, contributed greatly in the pioneer days to the understanding of those focal infections which concern lesions of the teeth. That there is a definite etiologic relationship between certain peridental infections, especially periapical lesions, and acute and chronic recurrent lesions of the joints and of the eyes will be agreed to by all. The beneficial effects of the removal of badly infected teeth and the correction of other infectious dental defects of the mouth have been so widely recognized as to influence appreciably the incidence of certain types of metastatic disease.

This effect is illustrated in the apparently changed incidence of acute iritis. Twenty-five years ago, it was currently held that syphilis was the cause of

*Read at the second annual meeting of the American Association for the Advancement of Oral Diagnosis, Chicago, Ill., Aug. 7, 1933.

perhaps 50 per cent or more of the cases of iritis. The remainder, aside from a certain small number occurring in the course of other recognized infections, were classified under the uninforming term of rheumatic iritis. The treatment was unsatisfactory and patients with recurrent iritis passed from physician to physician, usually receiving mercury and iodides, sometimes with relief, more often with progressively impaired vision. A few years study demonstrated quite clearly that the incidence of syphilitic iritis was much smaller than had formerly been thought, except perhaps in certain selected highly syphilized groups, and that a very large proportion of the average acute iritis was due to local infection. When these local infections were properly treated or eliminated, the iritis did not recur, or, if it did recur, reinfection of some other tissue was often demonstrable. When the relative ease with which perhaps 50 per cent of the cases of iritis could be successfully and definitely treated and cured became generally recognized, the incidence of these cases in any one year's series of observations steadily grew less, so that the incidence of the more chronic forms of iritis, especially those which are alleged to be due to tuberculosis, has relatively increased. This, of course, does not mean that the total number of cases of chronic iritis has increased. On the contrary, it means that the total number of cases of acute iritis has been so reduced by the correction of dental and other infections that, of the cases seen by any one ophthalmologist, a considerably larger proportion are the more chronic forms. It is of some interest to note that of the infections responsible for these cases of acute iritis about 20 per cent seem traceable to closed periapical lesions. These patients with recurrent acute iritis who have been relieved of the cause of their disability no longer have occasion to return to the ophthalmologist, and thus the correction of dental disease has affected the practice of ophthalmology. The same effects are becoming apparent in lesions of the joints. Recurrent acute infections and subacute infections of joints seem to have become less frequent in proportion to other forms of chronic arthritis.

But during this same period in which progress has been made, there have developed certain new difficulties. It has been assumed by physicians that if some cases of arthritis can be cured by the discovery and removal of peridental disease, most cases of arthritis can be thus treated successfully. The result has been the abuse of the theory of focal infection and the loss by many patients of serviceable and innocuous teeth.

The problem is one which calls for still closer cooperation between dentists and physicians and a clearer recognition on the part of the physician that acute and chronic infections of the mouth or of any other part of the body constitute only one of a number of conditions which determine the persistence and progress of the condition known as chronic arthritis. Even some of the dentists themselves evince what seems to be too great a willingness to cooperate, and, in some cases, sound teeth which were so unfortunate as to develop insensitive pulps have had their masticatory service terminated. As far as there has been bad leadership in this respect, much of the responsibility must be laid at the door of the physician. Further study and a better understanding of the relationship of other causes of chronic arthritis will overcome still other of the difficulties that we have been meeting during the past ten years.

There is another field in which medical thought seems to have gone far astray, and, from the advertisements seen on billboards and heard over the

radio, it would seem quite possible that the dental profession also has been somewhat misled. We are told that various mouth washes are extremely effective in ridding the mouth of bacteria, and impressive figures are cited showing the tremendous fatality among bacteria produced by the application of this or that preparation. These preparations do have certain antiseptic qualities, but, in the application of mouth washes and dentifrices, the important matter is the mechanical removal of materials which harbor the bacteria.

Vitamins and hormones, products of true scientific research of recent years, play a very large part in the human economy; but, unfortunately, we are asked to believe that the addition or subtraction of one or more of these vitamins, the lack of which may have affected the development of the teeth in infancy, will, in adult life, have an effect on the quality of enamel and dentin which has already been formed. It is this willingness on the part of many to indulge in superficial thinking and unscientific statements which makes us as a people so vulnerable to imposition by various foibles and fallacies.

As the years go on, I am impressed with the number of things that turn out not to be true or only partly true. At this time especially, when the need for clear thinking is just as great in economics and sociology as in dentistry and medicine, one is impressed with the peculiar mental state which seems to affect large numbers of reputed clear thinkers. Even in the realms of pure science, chemistry and physics, we observe that there is much discussion, not of facts, but of probabilities. In order that the science of medicine and dentistry, as well as other sciences, may grow, it is probably necessary that some turn from the beaten path and propose theories and hypotheses which may be supported by facts or may turn out not to be true. In any case, they will have served their purpose if they stimulate new thought. This indulgence in speculation by certain bright minds is no excuse for superficiality of thought on the part of the rest of us. Not many are qualified to think safely and logically without the steadying influence of experience and tradition.

This breaking away from the beaten paths of conservative thought is not confined even to the sciences. It is evident in expressions of modern art. Strange caricatures purporting to represent the human form constitute what seem to some of us a libel on the human body, at least from the medical point of view.

The explanation of the creators of these weird and unpleasant monstrosities is that they are trying to express something that they feel—that they have cast off the shackles of tradition—an answer scarcely satisfying to the common citizen. We move in cycles and, happily, we may look forward to a return to more pleasing forms of artistic expression.

Coming back to medicine: There has been a somewhat similar wave of revolt against tradition and experience in bacteriology. There are those who maintain that the pneumococcus may, under certain conditions, become a streptococcus with new qualities, or that other organisms may pass from a visible to an invisible form, and, as a corollary to this assumption, that new diseases may arise through changes such as occur in the growth of organisms in the culture tube. It is, of course, recognized that cultural environment does affect bacteria in a remarkable fashion and that, in the hands of trained bacteriologists, the pneumococcus family, for example, is found to consist, not of four types, but of at least thirty-two different types of organisms. We sometimes forget, however, that even

though these types do differ among themselves, they are still pneumococci and, under suitable conditions, cause lobar pneumonia, a disease which in its effects on the human body has remained fairly constant since the days of Hippocrates.

Medical education has undergone great changes in the last twenty-five years, with remarkable improvements in quality of instruction and output of students. Enthusiasm for research, highly important to the progress of medicine, has sometimes diverted attention from the necessity of preparing young physicians to care for sick people. At times, the quality of the alleged research has not been above question.

Dental education and medical education have much in common, and each can profit by close cooperation with the other. Cooperation is a function of equals and does not imply the subordination of one profession to the other. Each profession has its own tradition and discipline. It is probable that changes in dental education are desirable, but while tradition blindly followed is not a progressive leader, a careful and thorough survey of conditions old and new is necessary before it is safe to depart from the direction of tradition and experience.

I have referred to a few of the problems which physicians have to meet, many of which are of interest to the dentist. We must be receptive of changes incident to progress, but not too ready to discard all that experience and tradition have built up by years of careful observation. Whether it be a question of enamel or dentin or dead pulp or mutation of the agents of disease or mutations in education, we shall be safest if we make haste slowly. Physicians feel a serious responsibility in maintaining a safe leadership in medical problems, and we join most heartily with our dental colleagues in the study of problems concerning the mouth and teeth.

PROBLEMS IN ORAL SURGERY OF INTEREST TO THE GENERAL PRACTITIONER*

By GEORGE W. CHRISTIANSEN, A.B., D.D.S., Detroit, Mich.

THE extraction of teeth, in spite of greatly improved technic and a multitude of new and strange instruments, remains an extremely difficult, delicate and important operation. The problem is still to remove a calcified substance, the root, from a bony socket lined by fibrous membrane. The surgical, scientific method by which teeth are extracted now is an almost fabulous advance from the use of strong acids to slough away bone. And yet the task is still difficult, so much so that a man with good training and broad experience can be made to look like a novice, perhaps more than in any other field. We meet with cases wherein all our tricks fail and the result is obtained only by labor and that of an enervating kind.

Two problems confront the dentist in an extraction: prevention of pain and satisfactory removal of the tooth and any

*Read at a meeting of the Cleveland Dental Society, May 7, 1934.

diseased process attached to it or associated with it, without undue trauma. The first is accomplished through the use of a local or general anesthetic. Much is written and heated are the discussions as to which is the proper anesthetic, but one question should come first and will many times be the deciding factor: Are you capable of administering a general anesthetic and can you work with the patient asleep? If you cannot, other considerations, such as the patient's general condition, the type of operation to be performed and the amount of swelling, are of secondary importance.

Inexperience in general anesthesia evidences itself in many ways. False courage follows a few easy, short cases, until some difficulty arises which lack of training fails to overcome. It may be difficult to keep the patient asleep because of nasal obstruction. The range of safety in anesthesia may be narrow, resulting in persistent wakefulness or an annoyingly deep level; or there may be a struggle which prevents proper operating. After a few such experiences, fear and indecision replace the previous feeling of confidence, with the result that surgical anesthesia is seldom reached, and naturally the results are poor. The patients are disgusted with the operator and the method, and condemn them accordingly. Again, too much concentration on operating and too little on the anesthesia may permit the patient to slip into deep narcosis, with resultant collapse. To blame the anesthetist for this is not the cure because nitrous oxid-oxygen anesthesia in oral operations is a two-man job. Surrounded by such bugbears, one is wise indeed who decides against general anesthesia, if he depends on luck instead of on experience. Poor local anesthesia is excused by disease or thick nerve sheaths, but bad general anesthesia, besides being injurious to practice, is hazardous.

One of the deciding factors in the success of an operation in the mouth under general anesthesia is unquestionably the choice of a mouth gag. When a patient is anesthetized, there is a contraction of the muscles of mastication, so that if a nonrigid type of prop is used, it collapses, partially reducing the amount of separation planned, and one begins with a handicap. Reopening with a pressure gag is undesirable because of possible injury to other teeth. Therefore, in beginning, it is wise to choose carefully the position of the prop and place it as far posteriorly as possible. If teeth are missing in the upper or lower posterior region, it is well to use a prop of greatest length, which will extend from the edentulous area to the opposing teeth. Here, it is out of the way and is partially locked in position. If it is carelessly placed in the anterior part of the mouth, the mandible may swing laterally, vision of the field or posteriorly being decreased and the retrusion carrying the gauze pack and tongue backward to block the air passage. Much cyanosis and faulty anesthesia are due to an improper position of the mandible caused by ill-directed pressure of the mouth gag.

If work is to be done on both sides of the mouth, when one side is finished the bleeding area should be covered with gauze and the mouth prop placed directly against this. Such precaution prevents the blood from draining into the air passage and causing irritation and gagging. Additional gauze should be placed on the opposite side if there is any appreciable leakage around the throat pack. This improves the opportunity for satisfactory anesthesia, because the percentage of gases can be more accurately controlled, if the situation is not complicated by mouth breathing. Owing to insufficient instruction and preparation, the patient may begin to breathe too deeply and overexhale accordingly, during ni-

trous oxid induction. Unless this tendency is controlled, the anesthesia is liable to be unsatisfactory and the condition of the patient poor after recovery. An interesting and surprising report is made by Van Slyke showing the result of even a small amount of overexhalation.

The reaction of the blood is normally in the resting man expressed by a p_H of 7.4, slightly more alkaline than water. The p_H may be raised 0.2 or 0.3 above this level by such a simple physiological means as blowing off carbonic acid in voluntary overbreathing. And it can be lowered as much by the lactic acid produced in the muscles in a short, hard sprint. But if the change goes much farther in the alkaline direction the tetany of alkalosis sets in, nor can much greater change in the acid direction be tolerated without the symptoms of acid poisoning. The range within which life is continuously possible seems to be the narrow zone between p_H 7 and 7.8. When we consider that some molds can grow in 5 per cent sulphuric acid solution, it appears that the efficiency in our complicated and delicate organism has been bought at a very heavy cost in cellular hardiness and adaptability.

WHEN TO USE GENERAL ANESTHESIA

General anesthesia is most satisfactory in multiple extractions and alveolectomy, in obtaining drainage in acute cases by extraction or incision, in removing deciduous teeth and in the case of those in whom the hypodermic needle produces nausea or syncope.

WHEN AND HOW TO USE LOCAL ANESTHESIA

Surgical procedures in the mouth demand a good working knowledge of local anesthesia. No other method compares with it in the removal of impacted teeth; in extreme hypercementosis, where difficulty can surely be expected; in removing root fragments lying deep in the process, and for antral surgery. It is also necessary for patients who are not good anesthetic risks, cardiacs in whom compensation is poor, the tuberculous, those having elevated blood pressure, or advanced diabetes not controlled, and the patient who just does not want to lose consciousness.

The first requisite, of course, is unbroken asepsis, a fresh sterile solution and a sterile syringe and needles, the puncture point being dried and painted preferably with a tincture containing a reliable germicide. Recent investigations recommend a solution with a p_H as nearly that of the blood as possible, i.e., 7.4. Solutions were found having a p_H as low as 4, the resultant local condition not making for tissue health.

The injection should be made slowly without causing edema or blanching of the tissues, and if a deep injection is being made, the needle should be moved backward and forward to avoid causing a hematoma or similar accident.

EXTRACTION OF TEETH

Extractions may be classified under two headings: uncomplicated and complicated. Under the former are extractions of vital teeth with straight roots or gentle curvature, completely erupted teeth and nonvital teeth which are not hypercalcified nor extremely dehydrated. The second class comprises: 1. Unerupted and incompletely formed teeth, such as lower third molars removed early for orthodontic reasons.

2. Unerupted teeth covered with thick gingival tissue.

3. Impacted teeth or those which are incompletely erupted and are directed against an adjacent tooth and bone.

4. Roots with an abrupt curve which give promise of fracture.

5. Roots with a bulbous end caused by thickening of the cementum, a condition

which is termed excementosis or hypercementosis.

6. Roots which are completely submerged in alveolar bone, so-called buried roots.

7. Devitalized teeth where the structures have lost all elasticity and are extremely brittle.

8. Teeth with crowns destroyed by abrasion, lying in dense heavy alveolar bone.

9. Roots which seem to be attached by ankylosis rather than by the peridental fibers.

10. Upper second and third molars which do not loosen by ordinary extraction forces and in which continued pressure will result in breaking off the tuberosity and a large part of the antral floor.

TECHNICS OF EXTRACTION

After anesthesia is established, adaptation of the beaks of the forceps to the cervix of the tooth is the next important step. An instrument must be chosen which fits this surface accurately, so that properly applied force may be directed to the root and its attachment, and not dissipated through maladjustment. Good roentgenograms are of course invaluable, suggesting a method of procedure and pointing out many unsuspected difficulties.

Extraction of the two upper central incisors is usually accomplished by a simple rotating movement. This method is suitable for the lateral incisors as well, except in those cases in which there is a decided angle in the last few millimeters of root. A slight buccolingual pressure is sometimes helpful, but, in a devitalized tooth, this end may fracture, regardless of precautions, and it should then be removed by means of a small window through the process.

The upper cuspid may be very difficult to break from its attachment. Violent buccolingual pressure may break off a large portion of the cuspid eminence and weaken the attachment of the first bicuspid. Usually, a limited rotation in alternate directions is sufficient.

The upper first bicuspid, particularly when nonvital, is the source of much discomfort when extraction becomes necessary. Normally, the root is bifurcated, and this division may extend almost the entire length of the root, resulting in fine fragile roots. Any rotational movement is liable to fracture one of these just as is a buccolingual force. Probably most successful is the limited pressure to the buccal aspect after a small half-round blade has been pushed upward between the root and the socket wall. This permits slight lateral movement, which may be sufficient to break the attachment.

The anatomic form of the second bicuspid permits a slight rotation and pressure toward the buccal aspect. Root division is much more limited and hence root fracture is less liable to occur.

The roots of the first molar present a new problem. The three roots diverge from a common starting point and vary in size and shape. It is not unusual to find them acting as a sort of cradle for the antral floor so that buccolingual pressure results in perforation of the floor first by one or both buccal roots and then by the palatal tip. If this is continued, when the tooth is removed we may find that a triangular section of the antral floor is attached to the roots, a gaping wound into the sinus remaining. From this evidence, we realize that old warnings against such a procedure are justifiable. The situation is further complicated if a root tip remains because the danger of pushing it into the antrum is increased. Modification of a forceps design which permits a different application of force is of great value. A divided beak grasps the palatal

root firmly, which is not true of any round beak, and a curved, pointed outer portion can be forced high into the bifurcation area of the buccal roots. When this instrument is adjusted properly and an upward pressure is exerted to force it constantly higher on the root surfaces, a powerful downward pull is transmitted to the tooth without the danger of severe injury to the process. It is true that the crown portion sometimes breaks off, but, in spite of this, one or both of the buccal roots are loosened, and thus recovery of those which remain is simplified.

The second molar root normally is less divided, but much the same precaution is necessary because of the intimate relationship of its roots to the antral floor. If the crown is forced laterally, the buccal wall may be fractured and will remain attached to the tooth. This section of bone is normally a portion of the antral floor and an undesirable opening remains.

Management of the upper third molar is suggested by the roentgenogram. Usually, there are no difficulties here, unless the root perforates the antral floor.

In removing the lower teeth, a position posterior to the patient is helpful to many. The mandible can be grasped and steadied with the left hand and the forceps accurately manipulated with the right. This is particularly true in general anesthesia when forcing the mandible backward and downward interferes with breathing.

For the lower four anterior teeth, and sometimes for the cuspids, a straight instrument which permits direct rotation is very effective. In working from the right side, this method is often successful on the left bicuspids; while the right bicuspids are managed better with standard root forceps.

Because of its divergent roots, the first molar responds well to the pointed beaks of the so-called cowhorn. If both roots are not recovered, at least one is loosened, and the task is simplified.

Bifurcation of the second molar root, if present, is of less consequence, so that rotation may be used to advantage.

The third molar, of course, offers many surprises, and a careful study of the roentgenogram is the best guide. Much irreparable damage has been done to the bone on the distal aspect of the second molar by unwise pressure with an elevator, but there remains a place for the cowhorn when judiciously used. The third molar which is inclined slightly against the second and which has curved roots is more easily loosened by this instrument than in any other way. The beaks are introduced between the second and third molars and pressure is exerted on the third molar instead of on the second.

DIFFICULT EXTRACTIONS

Hypercementosis.—Probably, the most common factor in a difficult extraction is an increase in the size of the root by the presence of additional layers of cementum, resulting in so-called hypercementosis. The reparative power of the peridental membrane to lay down additional lamellae of cementum is well known. As a result, we find roots the diameter of which in the apical third far exceeds that at the gingival line. Extraction of such a root demands that the size of the socket be increased throughout to the largest diameter of the root or removal through the socket is impossible. This root enlargement is common in the lower bicuspids and molars; which explains why some of these are so difficult to remove.

When we have roentgenographic evidence that such a condition exists, it is better to prepare for additional work than to attempt removal of the tooth by

ordinary extraction forces and simply break off the crown. A useful procedure is to lift a liberal flap of gum tissue on the buccal aspect and then remove a small triangular section of the bony plate. The tooth may now be directed buccally and lifted out with comparative ease. This is not so simple if the crown and upper third of the root have been broken off and a bulbous mass remains in heavy bone.

Buried Roots.—Roots are sometimes found in the mandible under several millimeters of dense bone, which constitutes a satisfactory denture bearing surface. If this superficial bone is cut away, the ridge is destroyed, but if the approach is made through the buccal wall, no damage is done. A flap should be made and the roots recovered through a small window. This opening regenerates rapidly; the denture can be worn, and there is little soreness.

Sclerotic Bone.—Where absorption of bone has reduced the attachment of the teeth to the apical third, we usually find the bone very dense and movement of the roots difficult. To compensate for the reduction in the amount of support, Nature has increased the kind of support, with a resultant attachment that is almost an ankylosis. This is usually found where six or eight lower anterior teeth remain against a full upper denture. Because so much root surface is exposed, the leverage is increased greatly, and it is not common to fracture the majority of such teeth in their attempted removal. If a flap is lifted previous to extraction and a small bone bur is introduced between the roots, much trauma is prevented and the process is saved.

Unerupted and Impacted Teeth.—Probably nothing can be added to the excellent technics available for removal of the third molar which does not erupt normally. Any good technic demands ample access by way of a proper flap. If the tooth is horizontally inclined and submerged, overlying bone is removed to slightly beyond the cemento-enamel junction. The tooth is divided at this point. The crown portion is removed first and then the root is brought forward and lifted out.

This method is not applicable if the third molar is parallel to the second but lies distally and inferiorly from it. In such case, the bone covering the occlusal surface of the crown is removed and the tooth is divided longitudinally. The distal half of the crown and root is lifted out first, then the mesial portion is pushed posteriorly and brought out in a similar manner. As pressure with an elevator on this latter type is very liable to injure the mandibular canal, longitudinal division, regardless of how difficult, is the safer procedure.

Deciduous Molars.—The roots of deciduous teeth resorb irregularly, the misleading appearance resulting suggesting the need for further search. In removing the tiny fragments after the crown has been lost through caries, an elevator sometimes is used. Unless one is careful, a permanent bicuspid may be accidentally lifted out owing to the lack of attachment of these partly formed teeth. Histologists tell us that the first layer of cementum has no fibers from the peridental membrane, and is not attached, but simply lies in contact with the investing tissues. Thus, a slight pressure is sufficient to dislodge the tooth, thereby seriously injuring the permanent dentition.

OTHER ORAL OPERATIONS

During the last few years, the general practitioner has made much progress in the field of minor oral surgery. Simplified local anesthesia, without after-pain, and improved and more frequent roentgenograms have been factors in this progress. Because of the former, opera-

tion without pain or discomfort is possible to the patient. The second reveals pathologic processes where none are suspected. Besides this, the roentgenogram outlines the area and shows where curettement is necessary and just where to make incisions to expose hidden areas of disease.

Accompanying this new interest have come complications and accidents. Among the more unfortunate sequelae are: development of cysts resulting from inadequate drainage or recurrence of neoplastic growths because of incomplete removal or failure to sterilize the area; the forcing of root tips into the maxillary sinus, with the occasional unforgivable search through an enlarged tooth socket; cellulitis of the face resulting from ill-timed extraction usually of the lower third molar, the development of abscesses on the lingual surface of the mandible near the angle; osteomyelitis following extraction where no drainage can be expected; loss of a broken needle fragment in the soft tissues; sensory paralysis of the nerve supply of the lower lip following trauma around the mandibular canal; uncontrolled postextraction hemorrhage, and the occasional loss of partially developed permanent teeth during the extraction of deciduous roots.

Unsatisfactory results of these accidents may frequently be avoided or at least decreased, if sound reason and good judgment are substituted for haste in planning treatment when the case is not progressing satisfactorily.

CYSTS

Cysts of the jaws arise from retention in the tissues of some form of irritant, such as a portion of embryonic structure, or from active root end degeneration. They are common above maxillary lateral incisors in which the pulps have died and below mandibular bicuspids and molars. Frequently, because of curvature of the roots and the lack of space, the apical areas cannot be reached effectively with a curet after extraction, and diseased tissue remains, while granulation takes place in the socket, preventing drainage. In such cases, an incision over the apical region may reveal that the external wall of the process is destroyed, with extensive cavitation beneath. This affords easy and complete access, which must be had; if necessary, by making a window through the bone. Now complete curettement can be carried out and drainage maintained until healing is assured. Failure to obtain such a result may be the cause later of a large cystic growth with consequent bone destruction. Bloodgood[2] says,

> We have sufficient evidence from observations of both tumors of the lower jaw and elsewhere that there is an element of danger in opening, either through the mouth, or externally, one of these central tumors of the lower jaw and then cureting out the contents without thermal or chemical cauterization, since, after a microscopic study, we may find that we are dealing with a malignant tumor. In the giant-cell tumor, in the fibrosarcoma, the epithelioma or carcinoma, prevention of recurrence, prevention of resection of the lower jaw and even preservation of the life of the patient may depend on the first treatment.

GROWTHS ON THE SOFT TISSUES

The small, cauliflower-like proliferation of gum tissue developing from between the teeth is sometimes clipped off with scissors and thrown away. Weeks later, the patient returns with a recurrence, and sometimes the same treatment is administered. When we realize that the attachment of this growth may be deep in the peridental membrane, it is obvious that cutting away the upper structure is an impractical and unwise irritation which permits the underlying

fibers to penetrate deeper as a result of delay.

In removing such a growth, we must determine by careful dissection the origin of the basic fibers and remove the tooth or teeth involved. To protect the patient, the tissues must be saved, a frozen section made and the slide examined by a competent pathologist. For convenience, it is well to have a 10 per cent formalin solution at hand and a clean specimen bottle so that if unavoidable delay takes place in delivery, the specimen is not damaged for sectioning. Bloodgood recommends the following treatment for tissues from which a growth has been removed:

> When we do explore the central lesion of the lower jaw and are not prepared to make immediate frozen sections, it is safer, after thoroughly cureting the cavity, to wipe the bone surface with pure phenol, protecting the mouth with an alcohol sponge, and then mopping the mucous membrane with a salt sponge. The mucous membrane can then be protected with salt sponges and the cavity again wiped out with a piece of gauze saturated in a 50 per cent solution of zinc chloride.

ACCIDENTS INVOLVING THE MAXILLARY SINUS

Because of the structure of the part, upper third molar root tips are fractured during extraction, and since the antral floor is often very thin, being membranous only in advanced disease, attempted recovery of these fragments results in their being pushed up into the sinus cavity. Whether the direct contact with the mouth or the close relationship of the apices to the lining membrane is the cause, we do sometimes find an acute sinusitis within a few days after such an accident. If there was apical disease, it is reasonable to believe that a latent infection existed adjacently in the sinus floor and the root perforation was responsible for the condition becoming acute. If search for the root takes place through the socket, which has been enlarged with a coarse bur, the attempt may be unsuccessful, and if a purulent discharge develops, it pours down into the mouth, establishing an antra-oral fistula which it will be difficult to close without repeated efforts, and which may even resist the best attempts indefinitely. In contrast, if a window is made in the lateral maxillary wall just anterior to the attachment of the malar bone and in the curved surface high above the bicuspid and first molar root ends, an excellent view of the antrum is obtained. The root fragment is easily seen, and if there are unhealthy degenerative changes in the tissue near the point of perforation, this area can be cureted to insure healing. The soft tissue flap is brought down and sutured into position and generally healing is rapid. There is no difficulty in closing the window, because the buccal tissues hold the suture line in position; but this is not true of the tooth-socket operation. In the latter case, if there is chronic nasal disease, secretions from this will find their way into the mouth naturally, causing the patient distress and further complicating a satisfactory closure. The practitioner faced with the problem of root removal from the antrum will do well to weigh all facts carefully before proceeding.

CELLULITIS

Cellulitis of the face may develop into a grave condition and, at best, is serious, painful and distressing. One of the common causes is the extraction or attempted extraction of the partially erupted lower third molar, complicated by pericoronal inflammation and slight submaxillary adenitis. Removal of such teeth is often more difficult than anticipated, and while, in the absence of inflammation, we would

elect to use block anesthesia, we may feel that perhaps this one will be easier than it looks, and proceed under general anesthesia. The result may be extensive trauma of both soft and bony tissues, followed in a few hours by severe pain and rapidly increasing swelling, which often becomes huge; a temperature of from 101 to 104, and a rapid pulse. Usually, such a condition runs a course of from four to eight days, during which time the patient is wretchedly ill, unable to swallow except with the greatest difficulty and in extreme pain. Naturally, accusing fingers are pointed at the dentist, and he too is very uncomfortable. Extra-oral incision is usually necessary, and this is not kindly received either. In reviewing the facts, we are forced to admit that the trauma probably made possible the invasion of organisms; so we must conclude that, regardless of the distress the partially erupted third molar is causing, good practice demands reduction of the acute condition before extraction is decided on.

ABSCESS ON LINGUAL SURFACE OF MANDIBLE

Another unpleasant complication difficult to explain is that of the patient who returns a week or so after extraction of a lower molar, unable to open the mouth and complaining that swallowing is very difficult and painful. If superficially examined and advised to use sedatives till improved, he may experience a miserable week or two and then in disgust seek advice and relief elsewhere. In such a case, if a general anesthetic is employed and the mouth is forced open with a pressure gag, examination of the affected side will frequently reveal an abscess close to the bone between the angle of the jaw and the base of the tongue. Incision affords immediate relief, and such a finding should always be anticipated in the presence of such subjective symptoms.

OSTEOMYELITIS

Osteomyelitis of the maxilla may result from the presence of virulent organisms around an acute abscess at the root ends of a deciduous molar. If a child presents a history of severe toothache a few days previously, followed by a large hard swelling which still persists, and accompanied by elevated temperature, extraction should not be carried out unless there is assurance that there will be drainage through the socket. If the edematous mass has not begun to break down, extraction simply creates new routes of invasion for organisms. If extraction is delayed, hydrotherapy or some similar treatment usually brings about resolution of the swelling or produces localization, which rewards incision with satisfactory drainage. In contrast, immediate extraction may so stimulate the process that extensive involvement of the maxilla occurs. The direction of this is usually upward to involve the infra-orbital ridge and the soft tissues covering it. The presence on the face of a sinus results in a deforming scar, which is made worse if a portion of the ridge is lost.

BROKEN NEEDLES

The presence of a needle fragment resulting from a mandibular injection is not in itself injurious except for the unfavorable psychologic effect knowledge of it has on the patient. If an entirely unrelated false ankylosis or similar condition develops later, the presence of the needle fragment may be blamed and a damage suit brought against the dentist. In view of this fact, it is advisable to recover the fragment, and this should be done at once to prevent development of an antagonistic attitude on the part of the patient. Remarks from friends and neigh-

borhood gossip are not always productive of harmony and cooperation.

If the dentist does not know from experience that he can recover the needle, for two reasons in particular he should not attempt to do so. First, an unskilful search is usually unsuccessful, resulting in needless trauma, both mental and physical. The patient dreads a second attempt, and the task is magnified in his imagination to the extent that he may doubt the ability of any one to be successful in finding it. Secondly, the reaction of the tissues to trauma delays a second search, and during this interval the patient may develop a belligerent attitude and begin legal proceedings, with the usual bad advertising of the latter. To avoid these grave possibilities, is not the dentist wiser to seek counsel, and, if necessary, refer the case, should an uncertainty exist as to his own ability? The patient can be assured that the operation will be brief and without pain or unpleasant after-effects and, if carefully directed through such a procedure, he is virtually unarmed, and instead of seeking vengeance, he may even compliment all parties concerned on the good management shown.

Causes of Failure to Find the Fragment.—Thomas[1] describes an excellent and practical technic for this work. He explains that if the initial incision is made where the needle penetrated, the battle is more than half lost already. Here, one encounters soft tissue only, in an uncharted sea, and, incidentally, the needle is elsewhere. In contrast, if the incision is made from a known starting point, that is, from the anterior portion of the ascending ramus and the search is carried medially, the probabilities of success are much greater.

1. Thomas, E. H.: Removal of Broken Hypodermic Needles, J.A.D.A., 19:1747 (Oct.) 1932.

Good extra-oral roentgenograms are invaluable, and some information may be gained by making two exposures, one to locate the broken portion and the other with a needle held in the position of the mandibular block injection during exposure. These two may be made on the same film by covering one half of the casette with lead during each exposure. By comparison, one can rather accurately judge the position of the fragment and work accordingly. Usually, the object will be found close to the inner border of the ramus, above the lumen of the mandibular foramen and at an angle of about 35-40 degrees.

The incision should not be sutured and a gauze drain must be inserted to the deepest part of the dissection and left for twenty-four hours. Suturing the line of incision results in unnecessary edema and later adhesions which are unpleasant.

HEMORRHAGE

Troublesome hemorrhage may follow tooth extraction. If the bleeding is from a socket, packing with a piece of narrow gauze long enough to fill it completely usually acts as a satisfactory hemostat. If there are several bleeding points from a long incision such as follows an alveolectomy, a paste of tannic acid powder and epinephrine spread over the bleeding surface is most effective, the result being rapid and quite dependable. All old clots must be removed because portions of them form in the lumens of the small vessels and by preventing closure, permit oozing to continue.

POSTOPERATIVE CARE

The use of a gauze dressing should be anticipated when primary efforts at healing are liable to fail. In all difficult extractions in which there has been some trauma, and immediate clot formation has been prevented by instrumentation,

the probabilities that the original vascular mass will be lost are very great. Without nutrition, the clot dies and is destroyed by liquid putrefaction. This process can occur very rapidly, or three or four days may pass before the socket walls are without protection. The use of a gauze dressing immediately after extraction, besides slightly retarding bacterial growth, encourages healing and reduces after-pain by decreasing the exposure of the nerve endings. The wisdom of this procedure may be questioned, evidence being introduced that no healing can occur in the presence of gauze; but when healing is delayed, the dressing hastens and stimulates healthy granulation.

REQUIREMENTS OF DRESSING

Many so-called dry-socket treatments are available in the form of paste, and the instructions suggest simply that the socket be filled with this material. As many of these pastes are lost soon after insertion, a vehicle or retainer of gauze is highly desirable. Further, the wax or hardening control should vary according to the season. Thus, a cold weather paste should flow at a much lower temperature than one used during the warm months. Unless the paste has some degree of hardness and form, the mucin of the saliva prevents any close adaptation with the socket walls and little or no benefit is obtained from the dressing.

CONCLUSION

Finally, postoperative care is extremely important. The complaining patient becomes an old story, but it is well to remember that if we disregard the patient's report that pain continues and do not take time to find the cause, he may go elsewhere and, after a brief examination, find that relief was possible. Such experiences are injurious to practice and do not increase our prestige. Previous to dismissal after an extraction, the patient should be given verbal or printed instructions on after-care of the mouth. To send him away dependent entirely on his own ideas and the neighbors' advice is unprofessional. Our responsibility is far flung now and only by clear thinking, willingness to work and study and discussion with our fellows can we hope to maintain our place in the sun.

CYST OBLITERATING THE ANTRUM: REPORT OF CASE

By NATHAN KAPLAN, D.D.S., Brooklyn, N. Y.

A MARRIED woman, aged about 30, and five months pregnant, complained of severe pains in the right side of the face.

Examination revealed swelling along the border of the zygoma from the ala of the nose to the tragus. The nasal bone on this side was more protuberant than its mate, as if something from the inner surface had pushed it out. The eye on this side was sufficiently extruded from its socket to suggest an exophthalmia. Under the lips and cheek along the alveolar ridge, a long elliptic swelling extended from the cuspid to behind the third molar. It was fairly consistent, with no fluctuation or redness but some pain on pressure. On the palatal side, there was a "bagginess" of the tissues, which offered no resistance on pressure, as if no bone was present. This subsequently

proved to be the case. Only the first molar was missing. The two bicuspids were grayish and quite evidently pulpless. All of the teeth were somewhat loose.

The patient stated that the trouble had started more than five years ago with aching of the bicuspids. Over the long stretch of time, nothing had been done despite the gradually increasing growth of the swelling. For the previous three nights, the pain had become so intense as to be unbearable. She therefore consulted her dentist, who in turn referred her to me.

The history and the clinical findings indicated a cyst of unusual size. A complete series of plates and intra-oral films were taken. These small films revealed a cystic area so huge that they could not cover the total involved area.

The patient was given premedication, and the area was infiltrated locally high up in the mucobuccal fold with 2 per cent procain. A vertical incision in the median line was made well up into the lip, avoiding the muscle attachment. The interproximal gingiva was severed with a fine pointed lance and the tissue quite easily retracted with periosteal elevators as high as it would go. This permitted a good view all the way back to the condyle. The picture now presented another interesting phase. The pressure of the cyst had caused resorption of the alveolar facial plate to the extent that practically none of it was left. The roots of the teeth were visible and in line. The bicuspid roots, which were quite black, were unquestionably the cause of the trouble. All the teeth were now removed.

Fig. 1.—Portion of affected area, which was in toto too large to be shown on a small film.

The sac itself had an almost gleaming whiteness and was remarkably resistant. It extended "as far as the eye could see," occupying the entire exposed area from central incisor to condyle. Owing to its great bulk and transmission of pressure, it had caused the nasal bones to bulge and produced the exopthalmus.

Starting at the condyle with large spoon curettes, we proceeded to shell the cyst from its bony cavity. It was amazing to see how much pressure and pulling could be exerted against it and still cause no rupture. It was the toughest cystic membrane that I had seen. When about half way through, rupture was unavoidable owing to very firm attachment to the roof of the palate. A large quantity of fluid gushed out, flooding the cavity, the mouth and all. Cholestrin crystals so large as to be visible to the naked eye were evident in abundance. With this balloon-like bag collapsed, one could see that there was not the slightest trace of an antrum, the entire half of the maxilla being occupied by this growth. In the cuspid region, we encountered the branches of the anterior-superior alveolar nerve trunks, which we were very careful not to sever.

Fig. 2.—Portion of affected area.

When the entire sac was finally removed, the internal surfaces of the following bones were exposed clearly to view: the zygomatic arch, the nasal fossae, the under surface of the orbit of the eye, the ethmoid bone, the sphenoid and the wings of the sphenoid. Also, the palatal bones forming the roof of the palate were in view. The case suggested pictures that I had seen of soldiers who had had great sections of the face torn away by shrapnel, the cavities of

the face and head being exposed. The tissues were replaced and sewed into position with fourteen sutures. A gauze drain was inserted and the patient was dismissed with the usual postoperative instructions. The following morning, although the tissues were puffed up, there were no unusual untoward symptoms.

The gauze was permitted to remain in place for forty-eight hours. Upon removal, it was heavily impregnated with a foul-smelling, caseous material. The cavity was now thoroughly washed with hot physiologic sodium chloride solution. Large masses of this caseous substance were washed out. Large gauze drains were replaced and the patient was dismissed. Washing was resorted to every other day. At each successive treatment, the discharge and the foul odor became appreciably less, until in two weeks the area was absolutely clean. The drains were now left out and the wound was closed. At the present writing, the patient feels well and the exophthalmus has completely receded, although the nasal bone continues to bulge. The face is normal otherwise.

1031 Gates Avenue.

HISTORICAL RÉSUMÉ OF THE EVOLUTION AND GROWTH OF ORTHODONTIA*

By BERNHARD WOLF WEINBERGER, D.D.S., New York City

Millions on millions have perished without contributing to the progress of science; they have no history. Thousands have promoted at least the foundation of future knowledge, history records their names, for they labored. They summed up the past and discovered new and great truths, the intellectual products of many bygone factors of knowledge; they led humanity onward, and thus formed the landmarks of its history.—J. H. Baas.

IN writing the history of any branch of medical science, we can, and have to, approach the subject from different angles. The first questions we will wish to ask are: How old it is, how far back it can be traced in history, when and how it was first observed and how described. Then we will be interested in knowing whether the conditions were the same in ancient times as they are today, or whether they have changed their character. In order to answer such questions intelligently, we have to investigate all the available literature and, at times study and correlate the human remains as made accessible to us by archaeologic explorations.

After we have ascertained the incidence of the condition and observations made as to its etiology, classification, etc., the next problem to interest us will be how the condition was treated during different periods, what the operator did and what were the results obtained by various methods.

It would be impossible to discuss the evolutionary changes in orthodontia during the past hundred years without at least briefly reviewing its origin and development.

First, we must visualize the development of medicine; for, a hundred years ago, the cell theory and even bacteriology was unknown. Garrison briefly sums up

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 7, 1933.

the growth of medicine in the following words:

Primitive medicine, with its Egyptian and Oriental congeners, is essentially a phase of anthropology. Greek medicine was science in the making, with Roman medicine as an offshoot, Byzantium as a cold-storage plant, and Islam as traveling agent. The best side of medieval medicine was the organization of hospitals, sick nursing, medical legislation and education; its reactionary tendencies are mainly of antiquarian interest. The Renaissance Period marks the birth of anatomy as a science, with a corresponding growth of surgery as a handicraft. The best of 17th century medicine was purely scientific. Eighteenth-century medicine was again retrograde in respect of system-making, but has to its credit the beginnings of pathology, refined diagnosis (Auenbrugger), experimental and physiological surgery (John Hunter), and acquires an added social interest in relation to the beginnings of preventive inoculation (Jenner), and the formulation of a definite program of public hygiene (Frank). In the 19th century, the advancement of science was organized and scientific surgery was created. The interest of 20th century medicine is again social. . . .

The most noticeable things about recent medicine have been the trend toward cooperation and international solidarity, and the fact that nearly every important advance which has been made is prophylactic, i.e., comes within the scope of preventing the occurrence, the recurrence, or the spread of the disease. . . .

The tendency in all branches of recent science, even in zoology, sociology, therapeutics, internal medicine and surgery, has been to pass out of the descriptive into the experimental stage.

The alleviation of pain and the treatment of disease was the primary interest of early medicine, and, likewise, of dentistry. Patients came only because they suffered and needed attention. Prevention was as yet unknown. Therefore, both professions had a common point of view and a common basis of practice. The history of medicine and of dentistry are so inextricably interwoven that the consideration of one involves that of the other. Indeed, the physician forms the only bond of continuity in dental and orthodontic history between Greece and Rome and the middle of the eighteenth century. We must then look to medicine for our early information and data.

Not until 1530 can we begin to consider dentistry as something distinct from medicine. In that year, we have the introduction of that essential factor in the development and progress of a science; namely, a literature of its own. The Zene Artznei's (1530-1576) belonged to that class of medical publication of that date, and were devoted to matters of toilet and health. They were written for the lay readers, but they introduced to us the teachers and the teaching of the dental art as presented by them 400 years ago.

So-called dentistry, as interpreted from its own literature, began with the idea of educating the public along the lines of oral hygiene, and it was not until the early eighteenth century that we find definite care of the mouth undertaken.

We pride ourselves on our present-day dexterity and the successful manipulations of our present adjustment appliances, but I wonder if they evidence a skill more remarkable than did those of the Etruscans, Phoenicians, Inca Indians and others, when they, thousands of years ago, demonstrated with their crude instruments, and without our modern gas and electrical appliances, their wonderful attainments in mechanical dentistry. Their means of constructing their wonderful bridges was but the file, strings or wire and precious metals, and we have not progressed far enough to discard these same rudimentary tools.

Until 1900, dentistry was primarily in-

terested in correcting mainly "irregularities of the teeth," a condition thought by many to be something of fairly recent condition. Yet we find that the Neanderthal Man of 50,000-60,000 years ago had abnormalities in position, and irregularities, of the teeth, likewise supernumerary, retained, unerupted and impacted teeth. Also, the size of the jaw has not altered during these intervening years, nor do the number and size of their teeth differ.

Contrary to the contention of many, we find, in tracing early dental history, that modern civilization has not brought about, in man, a change in conditions, for existing conditions are as old as man himself; that observations regarding the position of the teeth and means for correction of malposition were made before the present era, and that many of our present-day theories and ideas relative to their cause are as old as the irregularities themselves and that we still cling to any number of these.

In the main, orthodontia had its origin in medicine, and has always remained an integral part of it, developing independently of organized dental education. Persons actively engaged in practice and the private schools, giving courses of short duration, have built up this field of work.

It had its beginning in esthetics. People sought relief because of the disfigurement of crooked and irregular teeth. There is historical evidence that the professional and the lay point of view have hardly altered during these centuries. Originally, people sought the advice of the earliest medical practitioners and, within the last few years, an attempt has been made, in some states, to again make orthodontia purely a medical proposition.

EARLY ORTHODONTIC HISTORY

Having thoroughly treated the early rise of our specialty in my history, it will not be necessary for me to review this period at this time. Many before Fauchard wrote concerning irregularities of the teeth and their treatment, but, as far as records show, there were few appliances mentioned. The form of the first appliance or by whom used is not known. There is no doubt that it dates back farther than the seventeenth century, for Fauchard mentions that the appliance did not originate with him. Without doubt, its introduction marks the most important step in the history of regulating appliances, and although it seems crude, the mechanical principles of the arch are the same today as in 1728. Its chief function was to expand the dental arch, and it is nothing more than what we now know as the expansion arch.

Early American Orthodontic Literature.—The history of orthodontia in recent times is replete with the names of men who have not only illuminated their own profession, but also, in some instances, have contributed to the sum total of knowledge in other branches.

Orthodontia in America is a story of endeavor and achievement that has not only brought this specialty to the favorable attention of the profession at home, but has also established throughout the civilized world the high status of the American orthodontist.

The advances that have taken place in the practice of orthodontia during the last seventy-five and especially during the past thirty years are so great and so important that one must pause and consider them for the moment.

Orthodontia in America, and especially modern orthodontia, which is a little more than 30 years old, shows several outstanding landmarks in its evolutionary course. These may be classified as: (1) early orthodontia, 1839 to 1880, from Harris to Kingsley; (2) orthodontia,

1880 to 1900, Kingsley to the establishment of the Angle School of Orthodontia and the American Society of Orthodontists; (3) modern orthodontia, 1900 to the present time.

The literature of the period of 1801, the year of the first publication in America, by Skinner, to 1839 does not include works of great importance and none of scientific value. Most of these were small books intended more to advance the reputation of the writer than to elevate a crude calling to a higher standard of excellence.

In 1839, dentistry in America was lightly regarded by the men of the medical profession, and orthodontia as a department of dental science was unknown. Little can be found, in reviewing the literature, aside from individual mechanical appliances and reports of cases. Orthodontia had little literature that it could call its own until 1880, when Norman W. Kingsley published his "Treatise on Oral Deformities as a Branch of Mechanical Surgery." Even here, we find that orthodontia was then included as a part of mechanical surgery. Two exceptions are found; one, an eleven-page essay on the "Importance of Regulating the Teeth of Children" by Solyman Brown, prepared by direction of the American Society of Dental Surgeons, in 1841, and "Observations on the Growth and Irregularities of Children's Teeth," in 1846, by W. H. Mortimer, 129 pages. Nearly all the books written during this period contained a chapter or chapters on irregularities of the teeth and a method of correcting them.

The first great work devoted exclusively to orthodontia was written by John Nutting Farrar (1839-1913) in 1888. Farrar, after fifteen years of conscientious labor, brought together his material and published the first volume of his "Treatise on Irregularities of the Teeth and Their Correction." This work, in two volumes (Volume I, 1888, and Vol-II, 1897), was founded "upon the results of actual experience, carefully recorded, from 1863 to the publication of the work." The two volumes contain 1,570 pages, with 1,400 pen and ink sketches by the author. They are a veritable mine of orthodontic literature and knowledge, epoch-making in character and make profitable reading to those practicing orthodontia.

During the same year, a number of other books dealing exclusively with irregularities of the teeth were given to the profession. Among them were "Irregularities of the Teeth and Their Treatment," by E. S. Talbot, 163 pages, and "Orthodontia and Malposition of the Human Teeth, Its Prevention and Remedy," 186 pages, by S. H. Guilford. There also appeared a small pamphlet, known as the first edition of Angle's work. This was followed in 1890 by Angle's "A System of Appliances for Correcting Irregularities of the Teeth." Since then, many volumes have appeared at regular intervals until now we have an orthodontic library of considerable size.

CONSIDERATION OF ORTHODONTIC PROGRESS

I have already mentioned the fact that orthodontia had its origin in the idea of esthetics and that, early in its history, the application of force was recognized as a means to correct the alinement of crooked or irregularly placed teeth. Therefore, alinement was the ideal with which our science was started. Until specialization began, those who devoted their time to this field concerned themselves with that idea. Afterwards, those men who devoted their entire time to this subject discovered that something more important had to be considered; that occlusion was

a developmental mechanism, and that it was not sufficient for teeth to merely meet; that they must meet in a definite way and bear definite relations to each other, as they constituted a unit, the human denture; that each tooth had inclined planes that occluded with a definite inclined plane of another; that the lower jaw had a definite relationship to the upper and could assume a number of positions; that, when this position was correct and the teeth in alinement, normal occlusion resulted. Later, this "normal" was found to be the "ideal," the average in percentages being the normal instead.

The recognition of the importance of correct occlusion changed the idea of orthodontia from merely "straightening teeth" to a more important problem, normal development of the face.

With the acceptance of the Angle classification, those in this country were pretty much in accord as to the basis of diagnosis, and, as a result, all had a common point to work from. Considerable headway resulted. At the same time, with a few exceptions, it was generally considered criminal to extract teeth to bring about a normal occlusion and better proportions of the face. Man was given thirty-two teeth and each was necessary for perfect results. About ten years ago, a few men broke away from this orthodox conception and again began to extract. My personal reason for this change was to justify certain failures and apparently simplify treatment. The result was a breaking away from our simple classification which complicated matters. Today, orthodontia is once more in a very unsettled state.

The quality of orthodontic treatment improved immensely from 1900 to about 1915, and the general trend of ideas, theories and fundamental conceptions was toward a healthy state. Those in the specialty were generally optimistic as to its future. Since 1915, there has been a gradual slipping, and today conditions are about as they were in 1900. The general practitioner is once more attempting to do this work, a large number of those specializing advocating extraction, and there is a generally unsettled state as to classification.

During this period of time, there has been a corresponding development in technic. Instead of the use of individual ligatures during orthodontic procedure, methods of attachment to the individual teeth have been developed which permit the application of constantly acting forces and better control of the direction and the amount of force applied to each individual tooth.

As far as the etiology of malocclusion is concerned, little progress has been made during the same period. We know today as little, as concerns etiology, as we knew thirty years ago.

As for orthodontic education, the colleges have made but little headway in its teaching. The postgraduate schools likewise fall far short of the first courses given. The introduction of certain legislation, as the Arizona law, into a few states shows that this unsettled condition complicates the situation, and, on the whole, the immediate future of orthodontic practice looks far less promising than in 1900 or 1910.

The thing that we have lost which gives me the greatest concern is the idealism of a generation ago. I was indeed fortunate to have known personally such men as Kingsley, Farrar, Guilford, Case, Jackson, Angle, and Talbot. They were the inspiration and incentive for better orthodontic practice.

EVOLUTIONARY STEPS IN ORTHODONTIC PROCEDURE

Facial Expression as Influenced by the

Teeth.—Hippocrates, the first to make a study of the human teeth, laid down the dictum "The greater the number of teeth, the longer one's life," while Aristotle (384-322 B.C.), a hundred years later, claimed: "The fewer the teeth, the shorter one's life." The love of beauty and the desire for white teeth was the primary consideration of the earliest authors; for Pliny (27-79 A.D.) remarks that "Ignatius because he has white teeth, is always laughing."

Our earliest record we find in the "Songs of Solomon": "The teeth are like a flock of well-selected sheep, which are come up from the washing," referring to their beauty and whiteness. Adamantus of Alexandria (B.C. 350) contends that not only do the cuspids contribute to favorable expression, but they likewise influence the character of the individual. Albucasis (936-1013) observed that irregularly placed teeth were particularly displeasing to women. Robert Woofendale (1742-1828) sums up the whole question in the following idea:

> Persons whose teeth grow in this disagreeable manner are desirous of hiding the deformity from view as much as possible with the lips, by which means they generally acquire an ungraceful habit of drawing the mouth on one side; and sometimes of endeavoring to draw the upper and the under lip, so as to conceal as much as possible all the teeth in the mouth; which has a formal and unpleasant effect, and prevents that freedom and ease in the conversation on which they would enjoy if freed from such restraint. Even, regular teeth are one of the greatest ornaments of "the human face divine"—give an elegance and expression to the countenance—and contribute, in an essential manner, to the beauty and regularity of the face; as, without such aid, the harmony of the most perfect set of features would be incomplete.

John Hunter (1728-1793) and Joseph Fox (1776-1816) are very much in accord with the same idea; while Duval (1758-1854), in 1802, in noting the relation of upper and lower jaws, expressed the idea that "the least deviation . . . diminishes the beauty of appearance" also that he "would that the ideas of the beautiful and marvelous did not so mislead us." Delabarre (1777-1862), in discussing the general condition of the dental profession at that time, 1819, states reluctantly: "Formerly, these bones (teeth) were regarded, indeed, as mere ornaments of the face, and consequently their preservation was rather the province of the perfumer than the regular physician"; though he concludes that "if the beautiful arrangement and regularity of the teeth give grace to the physiognomy, they are still of so much more importance to the health."

Leonard Koecker (1785-1850), in 1826, states: "Irregularity of the teeth is one of the chief predisposing causes of diseases, and never fails, even in the most healthy constitutions, to destroy, sooner or later, the strongest and best set of teeth unless properly attended to. It is thus not only a most powerful cause of destruction of the health and beauty of the teeth, but also to the regularity of the features of the face, always producing, though slowly, some irregularity, but frequently the most surprising and disgusting appearance."

Philippe F. Blandin (1798-1849), in 1836, went deeper into the development of the teeth and the influence of dentition upon the facial appearance than any of his predecessors; while Lefoulon, in 1844, takes a more serious view of this phase and emphasizes the ill-effect of lack of regulation in the development and expression of the face. "To extract is not to cure, but to destroy." N. W. Kingsley (1829-1913), as early as 1858, argued that it is "more conducive to the beauty of the individual that all of the perma-

nent teeth should stand in the arch." Calvin S. Case (1847-1923), in his "Facial and Oral Deformities" (1896), believed that "a large proportion of all facial imperfections, which in many instances amount to actual deformities, are due to an inartistic relation of those features whose form and contour are governed by the position of the teeth and the peripheral surface of the bone in which the roots are imbedded."

Edward H. Angle (1855-1893), in his "Malocclusion of the Teeth" (1907), finally sums up the various opinions expressed in a few clearly stated propositions: "The mouth is a most potent factor in making or marring the beauty and character of the face, and the form and beauty of the mouth largely depend on the occlusal relations of the teeth." He furthermore contends that "in order that our efforts may be intelligently directed toward the ideal, some rule, some principle, must guide us." The rule, worked out after exhaustive studies and careful observations, is "that the best balance, the best harmony, the best proportions of the mouth in its relation to the other features require that there shall be the full complement of the teeth, and that each tooth shall be made to occupy its normal position—normal occlusion."

Etiology of Malocclusion.—From the very beginning of man's interest in the teeth, we find that observations were made and attention given the question of the etiology of irregularities. Hippocrates, as already noted under "early history," speaks of the dolichocephalic skull and irregularities of the teeth; while Celsus attributes the cause directly to the retention of deciduous teeth. This same idea was mentioned by Crooke (1618), Dionis (1690), Berdmore (1768), Bunon (1741), Hunter (1771), Robert Woofendale (1783), Fox (1803), Murphy (1811), James (1814), Parmly (1820), Waite (1826), Maury (1828), Fitch (1835), Kneisel (1836), J. P. Clark (1836), DeLoude (1840), Lefoulon (1841), Desirabode (1843), Evans (1854) and Guilford (1874).

Paul of Aegina was the first to call attention to supernumerary teeth as a cause of malocclusion, a view held by Cooke (1618), Ruspini (1750), Berdmore (1768), Hunter (1771), Blake (1798), Margolin (1823), Joseph Harris (1830), Winckworth, Chapin A. Harris (1839), DeLoude (1840), Lintott (1841), Desirabode (1843), Arthur (1845) and Sewell (1869). Ruspini, in 1750, says: "All the teeth that exceed thirty-two may be regarded as supernumerary." He attributes irregularity of cuspids and incisors to extreme narrowness of the jaws. John Hunter says, "When there are supernumerary teeth, it will, in general, be proper to have them drawn; for they are commonly either troublesome, or disfigure the mouth."

It was not until John Hunter's time (1728-1793) that the mechanistic ideas were associated with etiology. He maintained that "that part of each jaw, which holds the ten fore-teeth is exactly of the same size when it contains those of the first set, as when it contains those of the second; and as these last often occupy a much larger space than the first, in such cases the second set are obliged to stand irregularly."

Robert Woofendale (1783) contends that it is the presence or absence of the deciduous teeth that controls the future of the permanent series, and "if proper attention were paid to the removal of the first set of teeth, the just symmetry and proportion of the second might be preserved." He thus advises careful supervision by the dentist. Robert Blake (1798) concludes that the alveolar arches continue to increase in width during the

entire progress of the formation of the teeth, and that irregularities are established during the period of development of the permanent teeth in the jaws; a truly biologic conception.

The various causes as presented by each writer I have fully considered in my "Orthodontics, An Historical Review of Its Origin and Evolution," but from this period to the appearance of Angle's "Malocclusion of the Teeth" in 1900, there is an apparent continuity of thought relative to the etiology of malocclusion.

Special mention must be made of those who, through independent efforts in investigation, arrived at etiologic factors of an entirely different character. First among them is J. Lefoulon (1841), who advances ideas different from those entertained by most authorities. They are based upon biologic phenomena controlling growth, form and dimensions of organs and tissues, such as: (1) constitutional differences brought about by social, economic and geographic conditions; (2) prenatal conditions, producing disturbances in size of the deciduous teeth; (3) a disease process, such as scrofula, that may affect the size of the permanent teeth; (4) sounds of speech in which the tongue strikes against the upper anterior teeth, pushing them forward.

These causes seem to have made little impression upon those interested in this subject, for the successors of Lefoulon either accepted the prevailing suggestions or advanced individual theories. Thus, Bridgeman (1856) formulated the mechanistic ideas in his "lateral pressure" theory.

Thomas Ballard (1864) developed his theory of "fruitless sucking," as the main cause of irregularities. Under this designation, the erroneous practices to which infants are exposed are enumerated. That Ballard's interesting and keen observations had little influence on the further development of orthodontia is borne out by the lack of his recognition in subsequent literature. There is, nevertheless, sufficient ground for his contentions to warrant a serious consideration of this matter. Also Talbot advanced some curious theories on this question. He says:

> Malnutrition resulting from disease, from insufficient or unsuitable food, and unhealthy environment, is the cause of idiocy, insanity, blindness and other defects. Derangement of the nervous system usually underlies these conditions as found among the poor. But there is another class of individuals who suffer from neurotic conditions. They are those who are well fed and housed but have overtaxed their nervous systems by improper modes of life and various forms of excitement. This want of balance produces an osseous system that shows excessive development in some of its parts and arrested development in others. Nowhere is this more manifest than in the maxillae.

According to Talbot, then, all malocclusion cases must be seen in neurotics, idiots or lunatics. It is unfortunate that the science of endocrinology was as yet unknown, for had Talbot had that knowledge, he would have been better able to express and to understand this problem.

The various etiologic factors considered were fifty-four in number and include every phase that one could imagine. The four lectures by J. C. Brash on "The Aetiology of Irregularities and Malocclusion of the Teeth," published in 1931, thoroughly reviews the entire subject, and the results of his studies indicate that "most of the conclusions at which we have now arrived seem to be negative." In other words, we have as yet made but little progress during the centuries in our etiologic studies, for we today are as much in the dark as ever.

Observations on Occlusion.—The evolution of the concept of normal occlusion

of the teeth is a fair index of the evolution of orthodontia as well as of dental science. Technic is not dentistry nor orthodontia. Mechanics is but a means. The end attained is the measure of success, and this success is measured by the degree of normal function restored. Thus, an appreciation of certain fundamental concepts of the nature of the masticatory apparatus must direct and control all operations if the greatest service is to be rendered. The concept of normal occlusion is involved in practically all phases of general practice, and it is in reference to this fact that orthodontia has made one of its greatest contributions to dentistry.

In the early stages of the development of orthodontia, little consideration was given to the relation of one jaw to the other as a whole, nor to the individual. Little study was made of this relation to the cranium, and so it was thought development would result, if we merely left the teeth in a normal, inclined plane relation. The early workers failed to realize that teeth drifted, and though they might reestablish a normal cusp relationship, at the end of treatment the entire denture might be in an abnormal relation to the entire cranium.

Celsus, when he suggested that a misplaced erupting tooth should be "pushed toward its place by means of the finger until it arrives at its proportions," must have had in mind a certain position in which the misplaced tooth would be in alinement with the others. Galen, though speaking of the function of the incisors as capable of cutting or biting, fails to mention the exact manner in which this should be accomplished.

It was not until the time of Hunter (1771) that we find a definite consideration of a relationship of the two jaws and occlusion of the teeth. In the consideration of his treatment of a protrusion of the lower jaw, he reveals the fact that his efforts were concentrated on forcing the lower incisors lingually from the upper; a correct conception of the normal relation of the anterior teeth. The same evidence may be obtained from his pupil, Joseph Fox (1803). Not until 1803 do we find a clear conception of occlusion of the teeth, and the belief that a positive relation existed between teeth adjacent to each other and those antagonizing each other. Duval states: "It is not sufficient that the teeth are properly arranged, by the side of each other, those of the upper jaw have a special connection with those of the lower, the least deviation from which diminishes the beauty of appearance. . . ." He also states that the conformation of the face almost always determines the order of the teeth, an idea still prevalent with many.

Bew (1819) called particular attention to the occlusion of the teeth and the importance of maintaining it, saying that one-half of each tooth occludes with half of the opposing one.

Leszai (1830) clearly outlines normal articulation, or what we today would consider occlusion.

Kneisel's (1836) observations on occlusion in comparison with those of Hunter, Fox and others showed a greater conception of the principles and assumed larger dimensions, owing to the improved scope of knowledge.

The views of DeLoude (1840), Lefoulon (1841) and Lintott (1852) as to the question of occlusion did not differ a great deal from that of Kneisel.

Desirabode (1843) failed to consider the relationship of the upper to the lower teeth; a fact rather astonishing when we take into consideration the knowledge he possessed of previous authors, as shown by liberal quotations throughout his work.

J. D. White (1850) gave evidence of a more extensive appreciation of the full complement of teeth in the dental arches, contending that the first permanent molars are the most important in the head.

W. K. Bridgman (1859) states: "The proper antagonism of the teeth is of the very utmost importance, for if any of the 'cusps' be out of place, they disturb the equal distribution of the force in biting, and tend to produce mischief at the points holding those cusps in their assumed position."

E. C. Angell (1860) emphasized the importance of the "first permanent molar," being the first to note the eruption of these teeth, their importance and the necessity of their retention, as well as all of the permanent teeth, in order to establish correct occlusion.

George T. Baker (1862) endeavored first to "create a natural articulation of the bicuspids and molars, leaving the anterior teeth to be treated at a subsequent period."

John H. McQuillen (1871) gives us the most adequate description of occlusion that we have as yet had. He states:

> On examining the articulation of a perfect set of natural teeth, it will be found that the teeth of the upper and lower jaw are arranged in such a manner that, owing to the difference in size, the superior incisors and canines, when the jaws are closed, lap over the upper third of the anterior surface of the inferior incisors, canines and half of the first bicuspids, while the crowns of the first superior bicuspids antagonize with the posterior half of the first and the anterior half of the second inferior bicuspids. This peculiar antagonism of the crowns of the bicuspids is continued to the molars, so that no two teeth oppose each other only, but each tooth, in closing the jaws, impinges upon two; so that, should a tooth be lost, or even two alternate teeth, still the corresponding teeth of the opposite jaw are to some extent opposed, and thus remain useful. For when a tooth is wholly unopposed, a process is set up in the jaw by which the useless organ is gradually ejected.

Alton Howard Thompson (1876) claims: "Occlusion seems a necessity to perfect development, for growth depends largely upon the irritation of use, and the desire to indicate a growing insufficiency of employment in the species."

Norman W. Kingsley (1879) is inseparably associated with the practice of "jumping the bite." By this procedure, he demonstrated that protrusion of the upper jaw is not necessarily corrected by extraction of the teeth, although he favored this at times, but rather by a readjustment of the two dental arches, bringing all the teeth into their normal relationship. This procedure consisted in shaping the dental arches so as to be in harmony with each other. Then the lower jaw was brought forward into occlusion with the upper, and was retained in that position until this relationship became the firmly established *modus operandi,* and at once changed the prevailing idea of protruding upper teeth to the true conception of distal occlusion, such as in Class II (Angle) cases.

Isaac B. Davenport (1887) amplified his views as to what constitutes correct or ideal occlusion, and the importance of trying to secure this occlusion in all cases treated. "By establishing normal occlusion, we can hope to secure results in orthodontia." His clear conception of the normal in occlusion is further illustrated by models, showing the buccal aspect in one, the lingual in the other and diagrams of the transverse molar occlusion. He strenuously opposed the extraction of teeth, "for besides the loss of important organs we shorten the bite, contract the mouth, disturb the facial expression and secure at least an arrangement of the teeth less favorable for their preservation than existed at first."

What was suggested by "occlusion" during the many centuries prior to the establishment of orthodontia as a profession is rounded out and perfected by Edward H. Angle in his work "Malocclusion of the Teeth" (1907). In his estimation, occlusion presents not only "the normal human denture in its completeness," but it also "includes the jaws, alveolar process, dental arches, and especially the teeth and peridental membrane, which to us are of prime importance." He also includes "the muscles of the lips, cheeks, tongue and mouth, the nasal passages, palate and throat, as these assist the teeth in performing their functions." To him, "the sizes, forms, interdigitating surfaces, and positions of the teeth in the arches are such as to give to one another, singly and collectively, the greatest possible support in all directions." "Each tooth," says he, "is not only in harmonious relation with every other tooth, but also helps to maintain every other tooth in these harmonious relations, for the cusps interlock and each inclined occlusal plane serves to prevent each tooth from sliding out of position, and, further, to wedge it into position if slightly malposed; that is, if not beyond the normal influence of the inclined planes." Therefore, he defines normal occlusion as being "the normal relations of the occlusal inclined planes of the teeth when the jaws are closed."

Classification of Malocclusion.—The earliest attempts to classify irregularities reveal an effort to classify certain forms in their relationship to one another. Progress was exceedingly slow as far as the consideration of this phase of our subject was concerned.

The first direct attempt at classification was made by Fox, and not until 1803. He based his group on the difference in the relationships of the anterior teeth; that is, whether the upper central incisors lock labially or lingually of those in the lower jaws. He then subdivided these groups in accordance with the number of teeth which assume such positions. There are four kinds of this irregularity. In the first, one central incisor is turned in, and the under teeth come before it, while the other central incisor keeps its proper place standing before the under teeth. That differences were observed earlier, but not so well defined, was shown by Bourdet in 1757 when he made the distinction as to the deformities that "exist only in the lower jaw, that is, in children who have protruding chins."

C. F. Delabarre's classification (1829) added little to Fox's principle. Nevertheless, he was the first to employ a terminology to indicate the four groups, as overbite, underbite, edge to edge and crossbite.

S. S. Fitch, in 1829, classified malocclusion as Fox did.

Marjolin (1823) advanced a slightly different series of terms from those of Delabarre, especially for the "maldirection" of the dental arches, choosing "prominence, recession and inversion" for the three main classes.

J. C. F. Maury (1828) followed out the plan of Marjolin, claiming that the dental arches themselves form a part of the irregularities of which we treat, as well as the teeth. As to the malarrangement of the teeth themselves, the cause arises from their inclination inward, outward or laterally.

Thomas Bell (1829) classified irregularities with regard to disturbances in the shedding of teeth, where the permanent teeth are crowded as "permanent" and the deciduous set as "temporary."

Kneisel (1836) classified irregularities into "general and partial distortion."

Blandin (1836) considered the changes produced by the teeth upon the dental arches and lower border of the

mandible, as well as the variety of teeth, according to different races and individuals. The teeth he classifies as to number, form, direction and position.

Lefoulon's classification of malocclusion of the teeth is somewhat like Marjolin's, but described in greater detail.

C. B. A. Lomnitz (1840) followed the classification of his contemporary Kneisel, according to the distortions of the teeth and the unequaled proportion of the arches.

J. M. A. Schange (1841) accurately described the occlusion of the teeth both buccolingually and mesiodistally, and recognized four varieties of irregularities.

Carabelli (1842) classified irregularities of the teeth according to the occlusal relationship in the incisor region, advancing a different series of terms and contributing an additional class, "the open bite," to those already described by his predecessors; while C. J. Linderer's (1844) classification varied from the others, as he based it upon the position of the teeth.

Paul Goddard (1844) states that irregularity may be divided as follows: (1) irregularity of position and direction; (2) irregularity of formation and shape; (3) irregularity of number.

M. S. Cartwright (1864) classified irregularities of the teeth according to three forms of the jaw which favored irregularities in the position of the teeth, the "hereditary," the "congenital" and the "mechanical."

Carl Wedl, in 1867, classified the forms of irregularities of the teeth into nine groups.

Kingsley (1872) classified the causes of irregularities as (1) developmental, meaning those that occur prior to the eruption of the crowns and (2) accidental, those that occur at the time of eruption or subsequently, and are either acquired or inherited.

A. Ogston (1874) classified congenital malformations of the lower jaw.

Magitot (1877) amplifies the classification of Schange, and greatly elaborates by dividing dental abnormalities into nine types. This classification was not devised to be used as an orthodontic classification, though it was an advance over those so far known, especially the classes of position and direction. On the other hand, Schange's was more nearly complete, for it pointed out and classified as well the relationship of the dental arches and the question of interdigitation of the cusps.

Georges Gaillard (1881), not satisfied with the classification of Magitot's, proposed six divisions, according to the position of the teeth.

Josef Iszlai, in 1881, and again in 1891 and 1904, proposed a new nomenclature according to the various ways of "biting," as well as the anomalies of the position of the teeth, based upon Carabelli's work.

Jean Redier (1882) proposed a classification which was general in character and similar to Magitot. He lays stress on the importance of the interdigitation of the cusps.

With Talbot (1888), the tendency to complicate this phase of the problem began. His classification is interesting and differed from those of his time.

Morton Smale and J. F. Colyer (1893), proposed the following classification: abnormalities in (1) size, (2) number, (3) position and (4) structure.

Calvin S. Case's classification introduced in 1908 is interesting as to the complication of it. He has divided this into two sections, the combined grouping embracing twenty-six divisions.

This classification was mapped out with the types of appliances that he utilized in their correction in mind.

In 1887, Angle introduced his "sys-

tem." With the dawn of this century (1899), he elaborated a classification and terminology which has done more to advance and simplify orthodontia than any one other step of which we know. The fundamental idea is that "classes are to be based on the mesial-distal relations of the teeth, dental arches and jaws, which depend primarily upon the positions mesiodistally assumed by the first permanent molars on their erupting and locking." This has, since 1899, because of its simplicity, and despite the various criticisms and the new ones at various times suggested, become the acknowledged classification.

Within recent years, a number of new classifications have been suggested that have again thrown this phase of orthodontic procedure into a chaotic condition. The main reason apparently seems to be to again justify the extraction of teeth and, at the same time, correct the seeming shortcomings of Angle's classification. I shall not dwell on these as they are still in an embryonic stage.

Means Employed in Treatment.—Following the observation that teeth might be out of correct alinement came the consideration whereby this condition might be corrected. From the simple method adopted by Celsus (25 B.C.—50 A.D.), who, after the extraction of a deciduous tooth that interfered with the eruption of its permanent successor, used his fingers to daily push the new tooth into its proper position, there gradually developed a series of appliances of almost every description and purpose. We thus find that the principles of mechanical pressure and extraction were simultaneously introduced.

At first, the idea was to bring about a better alinement, and, to accomplish this, it was thought necessary to work tooth by tooth. As other problems in orthodontia began to be considered and those factors which we have just discussed became recognized, there was a corresponding development in technic. The next step was the improvement in the control of forces exerted on the teeth during orthodontic treatment. Instead of the use of individual ligatures, which soon became loosened, there developed a force that would be more constant and that could continue over a greater period of time. Following this was a method to control the direction and then the amount of force that was required and applied to each individual tooth. This, according to Noyes, "in the mind of the operator must be interpreted in terms of its reaction upon living cells and the transformations which they produced in the supporting tissues." Along with this change of thought came the realization that only slight pressure was essential for treatment. (Oppenheim.)

The file was next suggested, first by Pliny (A.D. 23-79), and was the first mechanical means for correcting irregularities of the teeth. Its use remained in practice until the last century. The technic for the use of the file is given in detail by Dionis (1690). This method introduced a practice of mutilation which was condemned by many subsequently.

Albucasis (936-1013) suggested the first instrument, so far known, for correcting irregular placement of teeth, a small axe.

Pierre Fauchard, when he wrote his monumental treatise on dentistry, in 1723, conceived, for the first time, the idea that, in order to exert mechanical pressure by means of an apparatus, it is necessary to have sufficient resistance to the force to be exerted. He devised the "band" as he called it, which eventually developed into our modern expansion arch. The expansion arch, since its introduction, has undergone a number of modifications, some showing progress;

others showing merely differences without progress; others marking steps backward, and still others being mechanical absurdities.

Fauchard's principle of the arch has not changed, but its improvements have been toward refinement, so that in its present form better control of the distribution of force has been gained, not only for the movement of malposed teeth, but also in securing stability of anchorage. The result has been to increase its efficiency enormously and to lessen greatly its inconvenience to the patient.

The early forms of the arch, i.e., flat, square, or half-round, were changed to the more compact, sanitary and elastic form, i.e., the round, and later to the flat oval.

The crude methods of controlling the adjustment of the arch as to size have been supplanted by the ideal method, the use of the screw, and to the screw has been added as a valuable improvement the friction-sleeve nut, which in the most simple manner prevents the accidental loosening of the nut, besides reducing the bulk of its square, exposed portion to the minimum, and consequently lessening the inconvenience to the patient.

Until the discovery in 1839 of the process of vulcanizing rubber, most of the appliances consisted of bamboo, wooden wedges, metallic arches, inclined planes, etc. After the discovery of this important material, regulation of the teeth took on a new interest, innumerable appliances being constructed of this material, which in some sections of the country are common even at this date.

Bourdet (1757) carried the use of gold strips a step farther than Fauchard, and advised against the use of silver, "which turns black in the mouth."

Hunter (1771) advanced the treatment by introducing a "plate" to correct "projection, protrusion or prominence of the lower jaw."

Fox (1803) was the first to give explicit directions for correcting the irregularities of the teeth and his method of treatment was used for nearly half a century.

Following Fox's came a long series of diversified appliances: I shall merely list the important evolutionary steps by recording the author's names. Catalan (1808) (inclined plane); Murphy (1811); Delabarre (1815), whose appliance was the first to resemble the modern "Jackson crib" and we here find the beginning of a new era for orthodontia. He describes for the first time the principle of the lever to rotate teeth, as well as the screw, also the use of "the metallic box, or crowns" (band), a notable contribution to the science.

Then came Koecker (1826); Maury (1828) and Thomas Bell (1829). Imrie (1834) carried the treatment of irregularities of the teeth farther than any of their predecessors, and, although utilizing their methods, he introduced into orthodontic practice three principles heretofore not described: (1) the use of plaster models in conjunction with block tin; (2) caps (bands) soldered to the band (arch) to give greater surface for mastication and a means of anchorage; (3) the introduction of the gold biteplates.

Then came Robertson (1835) and Kneisel (1836), who was the first to describe a die and counterdie, obtaining his plaster models first from a wax, and then from a sulphur impression, and devising an impression tray similar to the one now in general use.

Harris (1839) employed a modification of Fox's idea of the expansion arch, which he attached to gold swaged bands (crowns) on the molars.

Schange (1841) mentions three ways of obtaining space in correcting irregularities. Gunnell claims to have used occipital anchorage in 1822, but did not

describe its use until 1841. Meanwhile, Kneisel published this idea of anchorage in 1836.

Next were Desirabode (1843); Maynard (1843); Linderer (1844); Rogers (1845); Mortimer (1845) and Ware (1845), the last mentioned recommending "a thin gold plate to fit the arch of the superior jaw, and the inside of all the molars and bicuspids and sometimes round the first molar."

Then came Tomes (1848) and Hullihen (1849), who was the first to advocate surgical procedure in extreme cases of protrusion of the mandible. The method was to resect the lower jaw and thus reduce the size. This procedure never became popular owing to the extreme seriousness of the character of the operation.

Engel (1849) endeavored to show that in children at birth, the angle of the lower jaw was between 135 and 140 degrees, and that this angle changed as children developed, and, in an adult, was again similar to that of a child.

Dwinelle (1849) and Gaine (1851) almost simultaneously, although one resided in the United States and the other in England, employed a new method of force to spread the dental arches and introduce an important principle into orthodontia. The jackscrew, or as some prefer to call it, screwjack, was intended to exert a positive force and later become a common means to correct irregularities.

Evans (1854) described a means of anchorage made by soldering a metal tube to the side of a plain uncemented band.

Westcott's (1859) method of treatment was "first to expand or spread the jaw laterally" by the use of a double clasp (for each bicuspid) on either side of the dental arch, with a curved silver wire across the palate, riveted to the clasps, but movable. This principle was first advocated by Lefoulon.

E. C. Angell (1860) emphasized the importance of the "first permanent molar," being the first to note the eruption of these teeth, their importance and the necessity of their retention, as well as that of all of the permanent teeth, in order to establish correct occlusion.

Marvin (1866) calls attention to the necessity of retention of teeth for physiologic reasons.

Magill claims to have used the plain bands, of platinum, in 1871, cementing them to the tooth.

Kingsley (1872) is inseparably associated with the practice of "jumping the bite."

Farrar (1875) was the originator of the broad theory of "intermittent force," this being considered not only the proper method physiologically, but also proving the most effective. He also was the first to recommend, in 1882, internal root movement of the teeth, "righting 'up' of crowns."

Coffin (1881) again introduced a new method of treatment, used by his father for many years and described for the first time by Coleman in 1877. The Coffin plate, so generally known, found immediate favor and was employed extensively during the next two decades.

Baker (1893) proposed his method of protruding the mandible by means of intermaxillary elastics.

Malocclusion is known today to be treated by either the Angle system of appliances, which has been represented by the expansion arch, molar bands, plain bands, wire ligatures and minor accessories; or by the Jackson system of appliances, consisting of a perfected "crib" originated by Delabarre (1819) and a modification of the w-shaped wire as used by Coffin. Between these two extremes many other so-called systems or methods appeared, but they cannot be considered as independent manifestations, for they

lean toward either the one or the other appliance. Of the Angle and Jackson ideas, it must be added, the former is a simplified, systematized course of procedure involving mainly the principles of treatment as based upon the Angle classification of malocclusion, while the latter consists of a mechanical training in the making of appliances for the great variety of individual manifestations of occlusal deviations. Thus, while the former aims at general systematic order and arrangement with a view to facilitating educational methods, the latter manifests a traditional attitude of individual instruction and specific application.

At the end of the nineteenth century, the great evolutionary process in orthodontia began. A clearer conception of orthodontic problems was gained principally through the careful study and application of fundamental principles by such interested co-workers as Farrar, Guilford, Jackson, Case and Angle. The creation, accumulation and classification of knowledge pertinent to orthodontic practice, as I have already shown, cannot be attributed to any one man or to any particular group of men. Some of the principles enunciated by Fauchard and others, back in the eighteenth century, are still basic. It must therefore be perfectly obvious that what we today know as the science of orthodontia has reached its present state by a gradual evolutionary process.

During this period, certain men have risen far above the average so that they have impressed themselves indelibly on the history of achievements in this field. The deeds and accomplishments of these men mark important epochs. Their contributions have largely laid the foundation on which we have built.

The Ninth International Medical Congress, in 1887, seemed to be the turning point in this country in orthodontic history, for, at that meeting, Ainsworth, Angle, Case, Jackson, Farrar, Goddard, Guilford and Talbot came into the picture. They were always vying with each other, each attempting to excel, and each promoting his own ideas.

SUMMARY

A brief summary of this period, in a general way, may be given as follows:

1. Esthetics was the basis of treatment. The type of face immortalized by the statue of Apollo Belvedere had been the adopted standard of facial beauty.

2. It is interesting, in the light of present-day developments, to note how the etiologic factors began to emerge, out of a mist of chaos, and became coordinated.

The hereditary transmission of irregularities of the teeth from parent to offspring was one of the first etiologic factors promulgated, because similar irregularities of the teeth of parent and offspring were observed. When an irregularity could not be traced to one of the parents, the union of races or of individuals of largely varying proportions was blamed for the deformity.

With such awe was this misconception of hereditarily transmissible characteristics looked on that such irregularities were considered unamenable to correction because of invincible tendencies. The next step was to think of irregularities as an arrested development equivalent to a physical decline of the individual. These cases were classed under the heading of degeneracy.

Whenever heredity failed, and degeneracy seemed to be an offensive explanation, lip-biting and thumb-sucking habits, premature loss or delayed shedding of deciduous teeth and other conditions were blamed as initial causes of irregularity of teeth. Degeneracy was rightfully considered as a superstitution which was being blamed for all conditions not under-

stood. The functions of the endocrine glands were then unknown; which misled Talbot and others in their interpretations.

3. The biologic problem was as yet unknown.

4. The conception of occlusion had progressed from a consideration of the individual tooth to that of "occlusion as the basis of the science of orthodontia," though the relation of the teeth of opposing arches was spoken of as "articulation of teeth."

5. A classification (Angle's) based upon the recognition of normal occlusion was accepted and did more to advance and simplify orthodontia than any one step of which I have knowledge.

6. The deformity which had been known as "irregularity of the teeth" was now being termed "malocclusion of the teeth" and the name "orthodontia" was being given the new science which dealt with the correction of malocclusion teeth.

7. The extraction of teeth was generally recommended.

8. Treatment was seldom begun or recommended until after eruption of the permanent teeth.

9. The mechanical phase was the most important, and given the greatest consideration.

10. "Prevention" had not been given a place in orthodontic treatment.

11. "Systems" of treatment of individual men were the standard procedure, to the exclusion of all other methods.

12. Standardized appliances were to be had at the dental supply houses, with instructions for their use.

13. Orthodontia was given little consideration in the curriculums of dental schools and its teaching was of minor importance.

14. Many persons were attempting to correct malocclusion without having the least conception of the principles involved.

15. Every dental practitioner considered this phase as part of his routine procedure.

16. There were no postgraduate or extension courses of study provided, nor were there any private schools of orthodontia.

We have thus seen that the outstanding facts in orthodontia so far are: The recognition of conditions known as malocclusion of the teeth; the sorting out of these conditions into groups possessing like characteristics (classification); recognition of deep-seated conditions that had to be considered (etiology); the discovery that malocclusion is responsive to mechanical stress, and the invention of mechanical appliances to be used for practical purposes.

CONSIDERATION OF MODERN ORTHODONTIA FROM THE PERIOD OF SPECIALIZATION

Remarkable Rise from 1900 to 1915.—To Edward H. Angle, orthodontia owes the renewed impetus instilled into our science. Probably no other man in dentistry did more to foster this branch of dental science as a specialty, causing its separation from general practice and advocating it as a recognized and distinct science.

The establishing of the Angle School laid the foundation of orthodontia as a specialty, and in order to fulfil the requirements, Angle helped organize in 1901 the American Society of Orthodontists, and was instrumental in founding an independent journal, *The American Orthodontist*, in 1907. We thus find that Angle did for orthodontia what Chapin A. Harris (1839-1840) did for dentistry.

In 1902, Angle strongly advocated the separation of orthodontia from general dentistry, making it a distinct specialty, and thus fulfilling Farrar's prophecy. For several years previously, he had devoted

his practice exclusively to orthodontia, and, by the training of the men received in his school, this branch became a distinct specialty.

The Angle School of Orthodontia was a radical departure from the prevailing ideas of those who contented themselves with attempted correction of "irregular teeth," and it is easy to understand that this conception met with an almost organized antagonism. But out of this school came the incentive for a better knowledge and understanding of this new department.

Fortunately, all postgraduate teaching and courses in orthodontia have been encouraged by the men in the profession. The dental manufacturers and the dental colleges were not interested, and for that reason the specialty achieved its remarkable scientific advancement.

To present briefly the trend of orthodontia during this period, and that it might not be considered just my own opinion, I wish to call attention to the article of Frank M. Casto, read before the American Society of Orthodontists in 1930, while considering the trend of orthodontic treatment:

> Through the concerted and enthusiastic efforts of the orthodontists, by personal contact with the dentists, by appearing before dental organizations, and by the publication of numerous articles in the journals, the value and importance of orthodontic treatment soon became recognized by the members of the dental profession, many of whom were quick to realize the opportunity offered in this field. The laity also became rapidly enlightened and were demanding service for their children. The supply houses and laboratories started an extensive advertising campaign. Standard sets of appliances to meet the requirements of every case were offered to the profession. Laboratories advertised that appliances suitable for use in the treatment of any case would be designed and constructed, either of the fixed or removable type, upon models sent to them by the dentists, at a comparatively small cost. The financial reward appeared attractive, the field fertile, and according to the advertisements, the operations were easy. Commercialism had crept in and the scenes began to shift rapidly. A large number of men were attracted by these propositions either to enter the field of practice exclusively, or to devote a small part of their time to this branch of the work. Some were qualified, some moderately so, and some were not qualified at all. Competition came into the picture, and there began a practice among a considerable number which largely ignored the results obtained in treatment. Frequently teeth were injudiciously extracted to simplify the work. The unscrupulous offered large commissions for the reference of patients. Diagnosis was given but little consideration. Appliances were selected with poor judgment, crudely constructed, and unskillfully placed. All available cases were put under immediate treatment. Fundamental principles were disregarded and the science of orthodontia was being prostituted. The trend of treatment was runnig its course with an incompatible mixture of good and bad, endlessly provoked by indirection and indiscretion.

In reviewing the situation during this period from a purely orthodontic point of view, we find a general change from the idea of just moving the teeth into alinement with mechanical devices, toward the biologic consideration of the problems involved. That the importance of this aspect was taking a greater hold on all of the leading men of the specialty can be seen if the literature is reviewed. Here, again, is one of the greatest contributions of orthodontia to dentistry, for as a result of this new approach, dentistry as a whole has materially progressed.

In order to understand and appreciate just what changes were occurring in our field, one must have some idea of a group of men then busily occupied in advanc-

ing orthodontia, for only those who knew these men can fully appreciate just what was taking place. These men were Kingsley, Farrar, Guilford, Jackson, C. S. Case, and Angle.

These men, the most prominent in the field of orthodontia, were in possession of the widest knowledge of the day and therefore exerted a strong influence in establishing the trend of treatment. While they often disagreed with respect to various methods, and frequently assumed an uncompromising attitude toward the use of certain types of appliance, they were always striving to improve conditions by advancing the science of orthodontia.

It is unfortunate that they permitted their personal feeling to interfere with their ideas, for had they been able to work in greater harmony, orthodontia would have been the gainer. No one can tell just how far it might have progressed. Fortunately, those in this field today do not need to contend with this bitterness and strife. Perhaps to this, we, working in greater harmony but lacking their aggressiveness, might attribute, in part, the gradual backward sliding of orthodontia.

Retrogression (1915-1933).—We are bound by tradition, and by the needs of the day, to do all in our power to advance the art, the science and the practice of orthodontia; not only for our own good, but chiefly for the protection of the people. What then are some of the problems that have caused the standards of orthodontic practice to degenerate from about 1915 to this date?

The graduated and trained orthodontic specialist who was fortunate to have entered its practice twenty or more years ago, who took an active part in its evolutionary development, and has witnessed the introduction, through orthodontia, of the many ideas that since have become a vital part of dentistry, cannot but view the present situation with considerable alarm.

Progress in the science of orthodontia will continue unabated. There has probably been more advancement made in this period than in any like period of its history. This is due to the many earnest workers in orthodontia, who have sacrificed their leisure hours and nights to advance their specialty.

The earnestness of their efforts to learn and bring to light such facts as would help advance the profession has reacted so favorably that men with scientific training and knowledge, in correlated sciences, have gladly cooperated with them whenever and wherever approached.

Our knowledge in physical anthropology has advanced owing to the efforts of such men as Gregory, Osburn, Boaz, Todd, Brash, Keith and their co-workers, as a result of the interest of Hellman, Noyes and others in our specialty, in this phase of the subject. Thus, the study of growth, development and physical treatment has enormously progressed.

We have a better conception of the influence of the endocrine glands and the part they play in the development of the teeth and the jaws, owing to the cooperation of such men as Jansen, Timme and Sajous.

The problem of nutrition and its importance as regards deformities and decay has received the consideration of such men as McCollum, Parks, and Shipley. Thus, the continual advancement along biologic lines, as well as many other scientific studies, first given consideration in orthodontia, has become an important factor and now receives proper consideration in dentistry.

How, then, does orthodontics today differ from the practice of twenty or more years ago? Mainly in its wider scope. The intensive study of the early graduates of the Angle School of Orthodontia helped to introduce physical an-

thropology, biology, embryology, endocrinology, pediatrics, physical diagnosis, psychology, nutrition and comparative anatomy into orthodontia. Their work brought an entirely new concept of the subject.

Orthodontia, therefore, no longer remained just a problem of tooth movement, but enlarged itself into the domain of medicine and the correlated sciences. It might fairly be considered the connecting link between dentistry and medicine.

The specialist today must be first a student and then a technician—quite the reverse of the average dentist. Yet the two identities must be well-balanced. The field of orthodontia has assumed such tremendous proportions that it is difficult for even the trained specialist to grasp the entire subject. How, then, can the average dentist hope to keep up with it?

Specialists in the practical arts and research workers are needed, and we must seek to develop once more the man who will have a sufficient understanding of orthodontia and other specialties in dentistry, including the many biologic sciences, and who will be able to appreciate the special problems engaging the attention of the various specialties. The detailed and practical work of the various specialties require special skill and training, such as no one man could hope to acquire.

Would that I could cease here, but there are many disturbing conditions that are at present far overshadowing this important specialty and that are gradually dragging it back to where it was thirty years ago.

One of the most important reasons for this decline is its present educational status. The special private courses are far below the standards set by Dr. Angle, for they not only lack the "ideals" he so instilled in his pupils, but likewise the fundamentals of orthodontia. The postgraduate courses attached to the dental school fail, in most cases, to meet the present requirements, while the dental schools are still floundering along, trying to determine just what to teach the undergraduate student.

Dr. Noyes has beautifully expressed the fundamental difference between dentistry and orthodontia and why dentistry has failed to make orthodontists.

When we take into account that dentists everywhere are again undertaking orthodontic cases and refer cases to another dentist, a so-called specialist, in every department of dentistry, and that the majority who are now "specializing" come directly from the dental schools, we cannot but feel that we are again just where we were thirty or more years ago. These men are today merely "straightening teeth" and the mechanical factor has again assumed its former significance. Contrast this with the ideals of the orthodontist who recognizes as fundamentals the problems of development and growth, and the intricate physiologic mechanism concerned in this process; who understands the difference between the physiologic and the chronologic age; who considers the biologic problems along with the mechanical; who refuses to consider every orthodontic case as the potential source of a "fee" and places appliances in every case and at any age, and who has the courage of his convictions in giving advice and keeping these cases, when there is a question as to immediate treatment under observation.

Meanwhile, the problems in our specialty have become more numerous and complex. More experience, backed by sound judgment, is required, and greater responsibility is placed upon our shoulders. A far more exact technic, requiring greater skill and care in constructing and adjusting appliances, is essential than ever before.

Here, we have the contrast that exists in America today in orthodontic procedure. There is little wonder that the laity little heeds the recommendations of a dentist, but attempts to use its own judgment in seeking advice and service.

Those of us who have watched this retrogression recognize that this inexperience, incompetency and unscrupulousness, combined with fee-splitting and commercialism, is what has caused the word "specialist" to be degraded. Unethical orthodontic and dental practices have a most baneful influence on the development of the young practitioner. In the early days, of this century, it was the ambition of the young orthodontist to advance by dint of hard work and close attention to his problems and to his patients, keeping himself in step with every advancement in the science and art of practice. It is painful to admit that, at the present time, advancement is not always secured in this way, but by alliance with a group of men who think less of the individual's merit and more of his financial prospects. The only way to rid ourselves of this danger is to destroy the den of iniquity by refusing to recognize it in any way. Fortunately, we today have one means whereby these individuals might be ruled out of the profession, whereby the laity might obtain advice as to "who's who." The dental profession must be the first to act and back those interested in again restoring orthodontia to its former high position. Otherwise, it will continue to disintegrate until it again finds itself in the situation that existed before the days of specialization. That means is the American Board of Orthodontia, by the certification of each specialist and the recognition of this certification by state authority.

BIBLIOGRAPHY

A bibliography on my subject will be found in my "Orthodontic History," pages 915-983. To this may be added:

Casto, F. M.: Trend of Orthodontic Treatment. Internat. J. Orthodontia, 16:1078-1090 (Oct.) 1930.

Garrison, F. H.: Introduction to History of Medicine, Philadelphia: W. B. Saunders Co., 1929, p. 670.

Noyes, F. B.: Undergraduate Teaching of Orthodontia, D. Cosmos, 72:514-521 (May) 1930.

Weinberger, B. W.: Orthodontics, Historical Review of Origin and Evolution, St. Louis: C. V. Mosby Co., 1926.

THE PENETROMETER IN DENTAL ROENTGENOGRAPHY*

By LOUIE T. AUSTIN, D.D.S., Rochester, Minn.

IN certain metabolic disturbances, an alteration of mineral salts in bony tissues occurs which can be demonstrated in the roentgenogram. Since lack of minerals in the structure of teeth is considered a factor in dental caries, dietitians are supplementing the diets of patients supposedly deficient in minerals with dicalcium phosphate or tricalcium phosphate, vitamin D, etc., in the hope that a change will occur in the bony tissues of these patients, and that this change can

*From the Section on Dental Surgery, the Mayo Clinic.

be demonstrated by means of the dental roentgenogram.

Many films have been made "before and after taking," usually for the purpose of demonstrating a definite increase in radiopacity of the alveolar process and, possibly, in dental substance. Ordinarily, in the instances in which this change was supposed to have occurred, there was a general appearance of underexposure in the later film. In making a comparison of two films for identical regions, exposed at different times, all factors should be the same. The considerable number of variable factors in the production of a dental roentgenogram are well known.

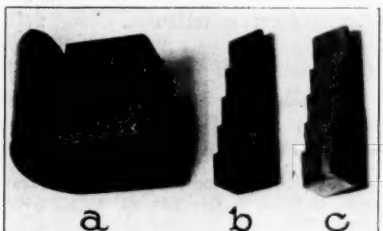


Fig. 1.—*a*, bakelite dental film block with terraced cylinder of magnesium inserted. *b*, bar of magnesium graduated in thickness, from 1 to 5 mm. *c*, bar of duralumin graduated in thickness from 1 to 5 mm.

The difficulty of producing the same photographic effect at a later date, as a means of comparison, makes it necessary, therefore, that a fixed basis for judgment as to the degree of exposure be established, and the penetrometer will be seen to accomplish this.

A method of measuring the quality of different radiations by absorption is to expose a suitable medium of varying thickness to the roentgen rays and to record the effect photographically on a dental film.

In 1896, Benoist produced a penetrometer of this nature, consisting of an aluminum ring of twelve equal sectors which varied in thickness from 1 to 12 mm. The roentgen rays would penetrate a definite number of the segments and give a photographic effect according to the degree of irradiation. Recently, for purposes of comparison, a rectangular bar of duralumin, 1 inch (2.5 cm.) in diameter (Fig. 1, *c*), was graduated into segments varying from 1 to 5 mm. in thickness. On irradiating this material to the extent necessary for dental exposures, it was found that too little of the metal had

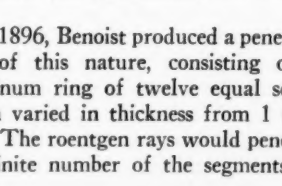


Fig. 3.—Comparison of shadows of penetrometers in two different films by means of light transmitted through a small opening. The difference in density may be noted. The only variable factor is the time of exposure. The upper film was exposed a half second less than the lower.

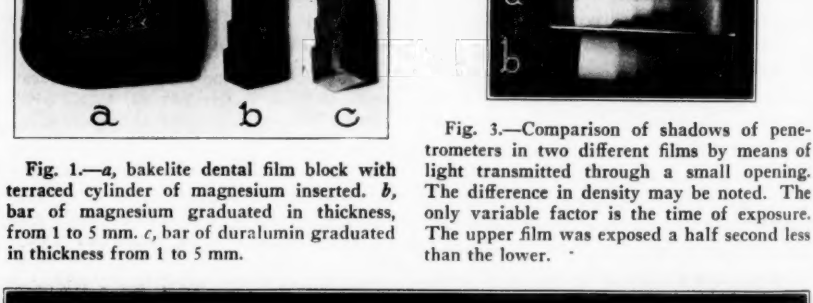


Fig. 2.—Series of dental films with a half second variation in exposure. The film on the left was exposed for half a second and, reading from left to right, each succeeding film was taken with a half-second longer exposure than the preceding one. The penetrometer in this series was of magnesium. The definite changes in density may be noted.

been penetrated. Magnesium has a specific gravity about half that of duralumin, and the same procedure was tried using this material (Fig. 1, *b*), with results that compare more favorably with those from irradiating teeth and bone.

In order to record the photographic effect, the metal must be exposed simultaneously with the tissues under examination. To accomplish this, a cylinder of magnesium was turned down on a lathe into five sections, starting at one end and making each succeeding section 1 mm. less in diameter than the preceding one. This terraced cylinder was buried in a block of pure bakelite (Fig. 1, *a*). Bakelite was chosen for the block as it is nonabsorbent and unaffected when placed in sterilizing solutions. Sections were made cylindrical rather than rectangular, as in Figures 1, *a* and *b*, in order that as long as the rays impinged at right angles to the axis of the terraced cylinder, the same thickness of metal could be penetrated in each section. Although these blocks can be used for an indefinite period, they can be duplicated, if necessary, by any competent machinist.

If a series of films of this instrument are made, varying a half-second in time of exposure, and other known conditions remain the same, it will be noted that when the films are mounted in the same sequence as to time of exposure, there is a gradual increase of penetration or burning out of the metal, as shown in each succeeding film (Fig. 2).

If this film block is used routinely in making all exposures, a record of a standard material is made. Should a comparison of dental tissues be desired at some later time, it is possible to reproduce, within reasonable limits, the same photographic effect as that shown in the previous film.

To determine that all conditions have been the same in both films, the shadows of the penetrometers alone should first be compared. This is best accomplished by viewing the two shadows placed side by side over a small opening through which light is transmitted (Fig. 3). Such variations as the difference of a fraction of a second's time of exposure or overdevelopment, film-target distance, etc., can readily be shown by the comparison of the photographic images of the penetrometer in the two films. We endeavor to employ a fixed film-target distance, temperature, time of development, voltage, etc., in all exposures, the only variable being the time of exposure.

If a film is to be made of part of a dental field for comparison with a film made previously, one should first compare the density of the penetrometer in the original dental film with that in a series of films such as in Figure 2, the various degrees of exposure in which are already known. In this way, the degree of exposure necessary to make a shadow of a density comparable to that of the original shadow can be ascertained. On production of the film, it may be necessary to increase or decrease exposure slightly to duplicate the shadow of the penetrometer satisfactorily. With the penetrometers in the two films registering the same density, it is felt that a suitable film has been produced, and comparisons can be made of the same dental tissues at different periods of time.

PULPECTOMY

By W. CLYDE DAVIS, A.M., M.D., D.D.S., Lincoln, Nebr.

SINCE the practice of pulpectomy, or pulp extirpation, if one prefers the older term, has been attempted with the thought that the apical tissues should be left in position, uninjured by surgical procedure, drugs or infection, the operation has seldom been followed by symptoms of periapical disease.

It would seem that semidevitalization and treatment with strong drugs is contraindicated. If exposure has existed for some time, presterilization treatment should be practiced.

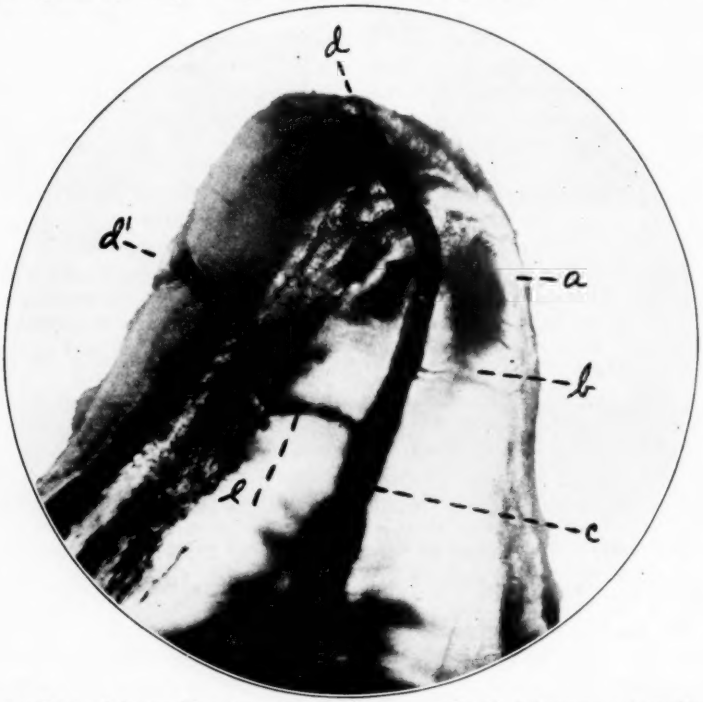


Fig. 1.—Upper right cuspid. *a*, cementum. *b*, dentin. *c*, pulp. *d'*, *d*, foramen. *e*, lateral branch. (×25.) In this case, an attempted pulpectomy would result in an unintentional partial pulpectomy.

The pulp should be removed while anesthetized near the accessible foramen. This should be accomplished with as

little broaching as possible. If lateral branches exist, they will be amputated where they leave the main canal, and will be subsequently plugged near the point of amputation with an osteoid tissue, some branches eventually becoming obliterated.

The canal should be dressed for three or four days with a mild antiseptic in which should be incorporated subnitrate

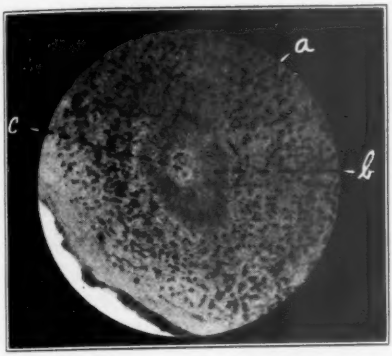


Fig. 2.—Ground cross-section of root at tip of dentin near mouth of foramen in molar after partial pulpectomy. *b*, cementum. *c*, osteoid tissue completely closing canal. (×50.)

Fig. 4.—Appearance of case, Oct. 21, 1932, after pulpectomy, Oct. 1, 1899. The results seem to be ideal. The foramen was left filled with vital tissue. A filling short of the foramen in putrescent cases would generally result in failure.

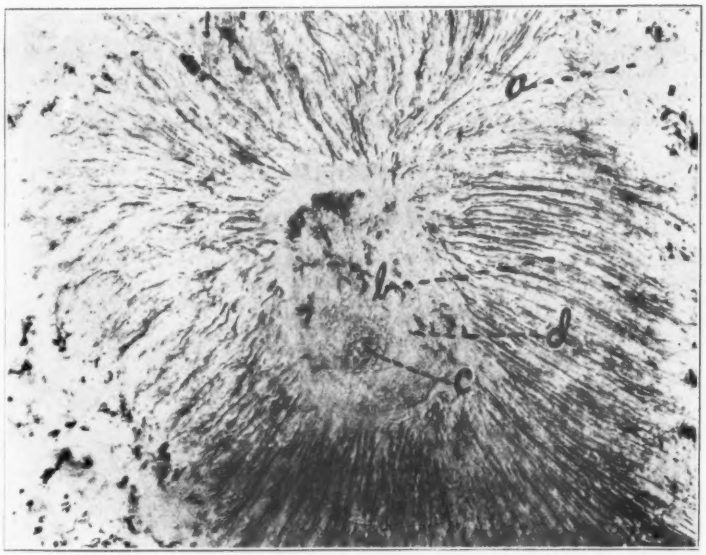


Fig. 3.—Magnification of section shown in Figure 2. *a*, cementum. *b*, dentin. *c*, remains of calcified artery. *d*, osteoid tissue filling canal.

of bismuth that we may determine by roentgen-ray examination the point or points of amputation.

There are many reasons for not practicing immediate canal filling, chief of which is the return of sensation near the foramen, to protect against anemia at the wound, retarding or preventing normal repair.

In filling the canal, the hard canal point should fall short of the wound, but set in a fluid varnish which contacts the soft tissue wound without pressure.

The canal filling should be neutral or mildly antiseptic. It should be very adhesive to dentin and cementum. The liquid part should contain a solvent for the canal point. None of the solids should be soluble in the fluids of the body.

The technic and mechanics of a canal filling following pulpectomy is distinctly different from that following any other division of canal surgery or therapy.

REVISED LIST OF DENTAL MATERIALS CERTIFIED TO THE RESEARCH COMMISSION OF THE AMERICAN DENTAL ASSOCIATION

By C. T. MESSNER,* Washington, D. C.

A revised list of dental materials (Sept. 17, 1934) which have been certified to the Research Commission by the respective manufacturers as complying with American Dental Association specifications follows. This list will be revised from time to time as new certifications are received or as materials are checked for compliance with specifications.

DENTAL AMALGAM ALLOYS
A.D.A. SPECIFICATION NO. 1
(J.A.D.A., April, 1934)

Alloy	Manufacturer
Argentum	Hammond Dental Mfg. Co.
Aristaloy	Baker & Co., Inc.
Banner	Goldsmith Bros. Smelt. & Ref. Co.
Blue Diamond	Reliance Dental Mfg. Co.
Brewster	E. R. S. Brewster
Certified	Lee S. Smith & Sons Mfg. Co.
Coe	Coe Laboratories, Inc.
Dee	Thos. J. Dee & Co.
Excel	Daniels Dental Alloy Co.
Keystone	Lee S. Smith & Sons Mfg. Co.
Minimax Nos. 172, 173, 174, 177, 178, 180, 181, 183, 161	The Minimax Company
Minimax White Gold and Platinum	The Minimax Company
Mission No. 5 and No. 6	San Diego Smelting & Refining Co.
Modeloy (Quick Setting)	Crescent Dental Mfg. Co.

*Secretary, Research Commission.

Odontographic "Improved"	Odontographic Mfg. Co.
P.D.Q.	Patterson-Hettinger Co.
Pearlol	Wildberg Bros. Smelting and Refining Co.
Preferd	Michigan Refining Works
Royal—Special First Setting	Garhart Dental Specialty Co.
Silverloy	Crescent Dental Mfg. Co.
67 Silver Alloy	Research Products Corporation
Specifi Alloy	Research Products Corporation
Speyer	Speyer Smelting and Refining Co.
S-C	Stratford-Cookson Co.
True Dentalloy (Filings)	S. S. White Dental Mfg. Co.
True Dentalloy (Cut A)	S. S. White Dental Mfg. Co.
Twentieth Century	The L. D. Caulk Co.
White Beauty	Lang Dental Mfg. Co.

Inlay Casting Investments
A.D.A. Specification No. 2
(J.A.D.A., December, 1930)

Investment	Manufacturer
Coecal Inlay	Coe Laboratories, Inc.
Coecal Universal	Coe Laboratories, Inc.
Kerr Cristobalite-Inlay	Detroit Dental Mfg. Co.
Kerr Cristobalite-Model	Detroit Dental Mfg. Co.
Kerr No. 3	Detroit Dental Mfg. Co.
Ransom and Randolph Gray	The Ransom & Randolph Co.
Ransom and Randolph Green	The Ransom & Randolph Co.
Ransom and Randolph X-45	The Ransom & Randolph Co.
S. S. White Inlay No. 20	S. S. White Dental Mfg. Co.

Impression Compounds
A.D.A. Specification No. 3
(J.A.D.A., January, 1931)

Compound	Manufacturer
Brewster	E. R. S. Brewster
Dresch	The Ransom & Randolph Co.
Kerr Black	Detroit Dental Mfg. Co.
Kerr No. 3	Detroit Dental Mfg. Co.
Kerr Perfection	Detroit Dental Mfg. Co.
Kerr White	Detroit Dental Mfg. Co.
Moyer	The J. Bird Moyer Co.

Inlay Casting Wax
A.D.A. Specification No. 4
(J.A.D.A., January, 1931)

Wax	Manufacturer
Brewster	E. R. S. Brewster
Maves	The Heidbrink Co.
Kerr Blue-Hard	Detroit Dental Mfg. Co.
Peck's Blue	A. E. Peck Mfg. Co.
Peck's Purple	A. E. Peck Mfg. Co.
Security	Cleveland Dental Mfg. Co.

Inlay Casting Golds
A.D.A. Specification No. 5
(J.A.D.A., January, 1932)

Alloy	Type*	Manufacturer
Chilcast No. 1	A	Vernon Benshoff Co.
Chilcast No. 1-A	B	Vernon Benshoff Co.
Chilcast No. 2	C	Vernon Benshoff Co.
Chilcast No. 2-A	B and C	Vernon Benshoff Co.
Chilcast No. 3	C	Vernon Benshoff Co.
Coe 1	A and B	Coe Laboratories, Inc.
Coe 2	B and C	Coe Laboratories, Inc.
Coe 3	C	Coe Laboratories, Inc.
Deetwo Light	A	Thomas J. Dee & Co.
Deetwo	B	Thomas J. Dee & Co.
Deesix	C	Thomas J. Dee & Co.
Goldsmith Inlay No. 1	A	Goldsmith Bros. S. & R. Co.
Goldsmith Inlay No. 2-Medium	B	Goldsmith Bros. S. & R. Co.
Goldsmith Inlay No. 3-Hard	C	Goldsmith Bros. S. & R. Co.
X Inlay	A	Patterson-Hettinger Co.
Knapp No. 1	A	Patterson-Hettinger Co.
Knapp No. 2	B	Patterson-Hettinger Co.
Knapp No. 3	C	Patterson-Hettinger Co.
No. 1 Hard Inlay	B and C	Patterson-Hettinger Co.
No. 2 Cast Inlay	A	Patterson-Hettinger Co.
No. 9 Cast Gold	C	Patterson-Hettinger Co.
Research Inlay A	A	Precious Metals Research Works
Research Inlay B	B	Precious Metals Research Works
Research Inlay	C	Precious Metals Research Works
Research-Hard Cast-No. 5	C	Precious Metals Research Works
Spyco Hard	B	Spyco Smelting and Refining Co.
Spyco Soft	A	Spyco Smelting and Refining Co.
Spyco No. 6	C	Spyco Smelting and Refining Co.
S. S. White No. 2	A	S. S. White Dental Mfg. Co.
S. S. White No. 1	B	S. S. White Dental Mfg. Co.
S. S. White No. 13	C	S. S. White Dental Mfg. Co.
Stern No. 2847	C	I. Stern and Co.
Stern No. 3290	B	I. Stern and Co.
Stern No. 3337	B and C	I. Stern and Co.
Stern No. 3375	A	I. Stern and Co.
Stern No. 3441	C	I. Stern and Co.
Stern No. 3465	B and C	I. Stern and Co.
T	B	Patterson-Hettinger Co.
TT	C	Patterson-Hettinger Co.
Tinker No. 1	B	Spyco Smelting and Refining Co.
Tinker No. 1H	C	Spyco Smelting and Refining Co.
Tinker No. 2	C	Spyco Smelting and Refining Co.

*Relative hardness: A, soft; B, medium; C, hard.

DENTAL MERCURY
A.D.A. SPECIFICATION NO. 6
(J.A.D.A., January, 1932)

Mercury	Manufacturer
Argentum	Hammond Dental Mfg. Co.
Chemically Pure	S. S. White Dental Mfg. Co.
Dee	Thomas J. Dee & Co.
Dental	Goldsmith Bros. S. & R. Co.
Mercury Laboratories	Mercury Laboratories, Inc.
Minimax	The Minimax Co.
Mission	San Diego Smelting and Refining Co.
Odontographic	Odontographic Mfg. Co.
Positively Pure	Garhart Dental Specialty Co.
R. P. C.	Research Products Corporation
Twentieth Century	The L. D. Caulk Co.

WROUGHT GOLD WIRE ALLOYS
A.D.A. SPECIFICATION NO. 7
(J.A.D.A., December, 1932)

Alloy	Manufacturer
Hylastic	Patterson-Hettinger Co.
Deepep-Hard	Thomas J. Dee & Co.
High Fusing Clasp	Goldsmith Bros. S. & R. Co.
Medium Clasp	Goldsmith Bros. S. & R. Co.
Regular Clasp	Goldsmith Bros. S. & R. Co.
Research No. 22	Precious Metals Research Works
Spyco No. 3	Spyco Smelting and Refining Co.
Spyco No. 4	Spyco Smelting and Refining Co.
Stern No. 2657	I. Stern and Co., Inc.

ZINC OXIDE IMPRESSION PASTES

By R. A. ROSS, D.D.S., Detroit, Mich.

PLASTER of Paris is the time proven material for impression plasters. Its position in prosthetic dentistry is secure. Recently, several new impression pastes have appeared on the market. These consist of a liquid and a powder, and they are unduly expensive as purchased under proprietary names. Cursory examination indicates that the powder is a mixture of zinc oxide and powdered rosin, while the liquid has an odor of oil of cloves. As neither the equipment nor the time was available for making a chemical examination of these materials, the assistance of the A.D.A. Bureau of Chemistry was requested.

The Bureau sent some suggestions which served as a starting point for a series of trials leading to a satisfactory solution of the problem. It was suggested that several mixtures of powders

made up of zinc oxide alone and mixed with rosin, and mixtures of liquid made up of oil of cloves, Canada balsam and

No.	Powder: Zinc Oxide	Powder: Powdered Rosin
1	67	33 parts by weight
2	85	15 parts by weight
3	100	0 parts by weight

No.	Liquids: Oil of Cloves	Liquids: Canada Balsam	Liquids: Balsam of Peru
1	45	45	10 parts by weight
2	80	20	0 parts by weight
3	75	25	0 parts by weight
4	60	40	0 parts by weight
5	50	50	0 parts by weight
6	85	10	5 parts by weight
7	75	20	5 parts by weight
8	60	35	5 parts by weight
9	50	45	5 parts by weight

Results of Mixing and Setting Trials

Trial No.	Powder No.		Liquid	Setting Time Hours* (At 82 F.)
1	1	+	1	Not in 24 hours
2	1	+	2	28 hours
3	1	+	3	24 hours
4	1	+	4	18 hours
5	1	+	5	17 hours
6	2	+	2	24 (partial set)
7	2	+	3	24 (partial set)
8	2	+	4	24 hours
9	2	+	5	18 hours
10	1	+	6	4 hours
11	1	+	7	3 hours
12	1	+	8	1½ hours
13	1	+	9	1 hour
14	2	+	6	2½ hours
15	2	+	7	2½ hours
16	2	+	8	1¾ hours
17	2	+	9	1½ hours
18	3	+	2	24 hours
19	3	+	3	24 hours
20	3	+	4	18 hours
21	3	+	5	14 hours
22	3	+	6	24 hours
23	3	+	7	22 hours
24	3	+	9	12 hours
25	3	+	9	12 hours

*Reducing temperature to 70 F. cuts setting time about one-half.

balsam of Peru be made and the setting times and working properties be determined under the conditions of the dental office. The experiments and observations carried out are given in the accompanying tabulation.

CONCLUSIONS

Experiments in the mouth could not be so extensive, but a few were made. As a result, it can be stated that:

1. Powder 2 plus liquid 8 works best in the mouth and sets in about five minutes. Evidently, saliva hastens setting better than does tap water.

2. Ten parts balsam of Peru makes the liquid too dark.

3. Addition of balsam of Peru hastens setting.

4. Addition of balsam of Peru removes burning sensation caused by oil of cloves.

5. The addition of olive oil slows up setting. Retardation occurs according to the amount of olive oil added. For impressions, olive oil is to be avoided, as a quick set is desired.

6. Use of a warm glass slab retards setting.

7. Use of a chilled glass slab hastens setting time at 70 F. to about one-half that at 82 F. slab temperature.

Other observations are that:

1. The increase of zinc oxide hastens setting time.

2. The rosin must be finely ground.

3. A white rosin is preferred.

4. A large amount of rosin is not necessary—only enough for a binder is desirable.

5. If there is any balsam of Peru in Dr. Kelley's impression paste, it is not noticeable.

6. The balsam of Peru appears useful—about 5 parts in 100 being desirable.

7. The addition of powdered asbestos (or magnesium oxide asbestos) does not improve the product.

8. Oil of cloves and Canada balsam do not readily mix. On standing twenty-

four or, better still, forty-eight hours, a perfect mix takes place.

9. As with Wondrpak and Silvodent, so with Dr. Kelly's impression paste, all are easy to compound in the dentist's own laboratory at a great saving in expense.

10. The powder should not be unnecessarily exposed to air, to avoid taking up moisture. It should be kept well stoppered.

11. The liquid may be measured out with a medicine dropper.

SUMMARY

Various mixes of zinc oxide impression pastes set at different periods.

A zinc oxide "impression paste" that fulfils all legitimate requirements may be made by mixing together a powder composed of zinc oxide, 85 parts, and white powdered rosin, 15 parts by weight, with a liquid composed of oil of cloves, 60, Canada balsam, 35, and balsam of Peru, 5 parts by weight.

The foregoing presents in detail a method of working out the properties of a suitable zinc oxide impression paste that may be mixed by the dentist himself at a considerable saving.

The above described series of simple experiments carried out in my office prompts me to mention several professional economic aspects of this experimentation.

It is apparent from the work done by the A.D.A. Bureau of Chemistry and the Council on Dental Therapeutics that their aims to protect the public, to aid the dentist and bring about truthful advertising of the products within their purview are being realized. One may, therefore, ask why there is not an effort by all dentists to aid the Council. By aiding the Council to accomplish its objects, the dentist aids himself and, more importantly, his patient. It is the accepted position of modern dentistry and medicine that the dentist and physician should know the composition and the therapeutic results to be expected from the use of drugs, apparatus and related materials. In dentistry, this applies not only to the medicinal aspect but is also relevant to the practice of restorative dentistry. When this idea is generally accepted in dental practice, the dentist will refuse to become a party to using or dispensing products of doubtful origin or secret composition. The above-mentioned example has an economic aspect. One further example will be illustrative. Several years ago, a detail man called at my office, handing out sample tablets for clinical use. These tablets, contained in the small envelope to be handed out to the patient, were of the kind that have been sent to dentists so freely in the last two decades. The outside of the envelope contained the usual suggestions regarding not only dental uses, such as after-extraction pain or soreness, but also treatment of all other aches and pains. The ingredients were not stated further than to call attention to the presence of acetanilid. No doubt because the presence of this dangerous drug must be declared according to the Food and Drugs Act of 1906, this sample dispenser, as a maker of fortunes, later confided the recipe. Any distributor who can induce 5,000 dentists to hand out his samples to patients assures himself a good sized fortune. Therein, in my opinion, lies the answer to the flooding of samples into every mail that the dentist receives. It is easy to dismiss the patient with a few tablets all nicely put up and ready to hand out with the manufacturer's advertising on the envelope, but what about the patient's health and what about our prestige?

This and similar incidents should impress us with the necessity for vigilance. It is one valid reason that every dentist should support, aid and encourage the

Council on Dental Therapeutics, the work performed at the Bureau of Standards and all other research and experimental work which tends to counteract unfair exploitation of the profession and the public. These thoughts may appear to be somewhat afield from the title of the paper, but the principles involved apply to impression materials as well as to products used by the patient. In one case, the dentist's reputation and the patient's pocketbook and possibly his health are affected. In the latter case, the dentist's pocketbook is affected.

It was shown above that by securing a little information from a reliable source, and without making an analysis of the impression pastes now on the market, it was, nevertheless, possible to duplicate these products and, in some cases, to improve the final results by the application of the experimental method. The results are given above in detail to illustrate how easily the average practitioner may duplicate the working properties of these expensive materials with the expenditure of only a little time and money, and last but not least, with a large saving. With a little calculation, it may be seen that the savings in some cases are large enough to help defray the dues to the local, state and national dental societies.

1706 Eaton Tower.

CONGENITAL ABSENCE OF TWENTY-THREE PERMANENT TEETH: REPORT OF CASE*

By BOYD S. GARDNER, D.D.S., and JOSEPH L. DILLERY, D.D.S., Rochester, Minn.

A BOY, aged 15, was brought by his parents to the Mayo Clinic for examination. He was sent to the Section on Dental Surgery as a part of the general examination. Complete roentgenographic examination revealed congenital absence of twenty-three of his permanent teeth.

The patient was apparently well, but looked somewhat undernourished. His mother stated that he was not a healthy baby. Both parents of the patient appeared to have normal dentitions.

Dentition of patient in whom twenty-three teeth were congenitally missing.

*From the Section on Dental Surgery, the Mayo Clinic.

INSERTION OF SILICATES WITH THE AID OF COMPOUND IMPRESSIONS

By M. FELSHER, D.D.S., Chicago, Ill.

THE filling of anterior teeth with silicate is one of the most beautiful phases of operative dentistry. It is accepted everywhere as a reliable and satisfactory way to fill anterior teeth. The possibilities from the esthetic point of view are a revelation.

The proper handling of silicate demands a definite technic, and any deviation therefrom means a poor end-result. The small proximal cavities are easily handled. The larger cavities involving two surfaces require much more skill.

A technic employing compound impressions for inserting silicate fillings involving one or more surfaces will be described. After correct cavity preparation, inlay wax is used to reproduce the natural tooth. The wax is thoroughly chilled and coated with oil. Modeling compound is then heated to a plastic state and a lingual impression is taken, involving several adjacent teeth, mesiad and distad from the tooth being operated on. This compound is chilled and removed, without disturbing the wax. The compound is trimmed sufficiently to permit an accurate labial impression, which is taken with the lingual impression in position, sufficient oil being used on the compound to act as a separating medium. The labial impression is now chilled and both impressions are removed. The impressions now have an exact imprint of a well formed and nicely contoured tooth, also of several adjacent teeth on either side.

The wax is now removed, and the cavity completely cleaned and dried. Cotton rolls are used, and, to insure a perfectly dry area, 10 per cent trichlor acetic acid is used under the free margin of the carious tooth and each adjacent tooth.

The lingual impression is coated with cocoabutter and placed in position and held there by the assistant.

The porcelain silicate is mixed very carefully and is placed in the cavity, the material being worked well into the undercuts and against the lingual impression. A slight excess of material is placed and the labial impression forced to position. The impressions are held in place with some force until the silicate has hardened. The impressions are then removed and the slight excess is removed with a sharp chisel. The filling is coated with cocoabutter and moisture is kept away from it for at least ten minutes. The patient is then dismissed and the polishing is completed at a later date.

This technic gives excellent results on teeth with large cavities. Beautifully contoured and well condensed fillings are then obtained that will stand up very well, provided the bite will permit a filling of this type.

It is therefore possible, in many cases, to save a tooth from being cut down for a porcelain jacket crown. This type of restoration is valuable in anterior teeth of children with large cavities where porcelain jackets are not indicated.

This procedure has been a great aid and results are very gratifying.

55 East Washington Street.

NATIONAL BOARD OF DENTAL EXAMINERS

In May, 1933, there were eighty-three candidates in Part I, of the examination of the National Board of Dental Examiners, as noted in THE JOURNAL for September, 1933. Herewith are statistics and the ten highest grades for the December, 1933, and May 1934, examinations. In May, 1933, there were four examination centers; December, 1933, eight; May, 1934, thirteen. In December, 1933, there were forty-five candidates for Part I; in May, 1934, 108 for Part I and sixty for Part II.

For the Part I examination, Dec. 8-9, 1933, the distribution of candidates for the nine examination centers was as follows:

Pittsburgh, Pa.	10
Washington, D. C.	8
Richmond, Va.	7
Baltimore, Md.	6
Iowa City, Iowa	5
Minneapolis, Minn.	4
Philadelphia, Pa.	3
Boston, Mass.	2
Total	45

Of the forty-five candidates, six failed, a 15 per cent failure.

For the Part I examination, May 25-26, 1934, the distribution of candidates in various examination centers was as follows:

Chicago, Ill.	25*
Kansas City, Mo.	20
Philadelphia, Pa.	16
Pittsburgh, Pa.	11
Boston, Mass.	9
Iowa City, Iowa	6
Minneapolis, Minn.	6
Louisville, Ky.	5
Ann Arbor, Mich.	5
St. Louis, Mo.	3
Baltimore, Md.	1
Washington, D. C.	1
Total	108

*Division of candidates in Chicago: Chicago College of Dental Surgery, 21; University of Illinois, 2; Northwestern University, 2.

Of the 108 candidates taking Part I, nineteen failed, a 17.5 per cent failure. Five candidates paid their fees, but were unable to take the examination.

For the Part II examination, May 25-26, 1934, the distribution of candidates was as follows:

Pittsburgh, Pa.	14
Minneapolis, Minn.	13
Chicago, Ill.	12
Washington, D. C.	7
Richmond, Va.	5
Baltimore, Md.	4
Iowa City, Iowa	4
Boston, Mass.	1
Total	60

Of the sixty candidates, there were eight failures, a 13.33 per cent failure.

The Secretary read the names of the candidates having the ten highest averages for the Dec. 8-9, 1933, Part I examination as follows:

Candidate	Name	School	Average
121	Martin Sunnenblick	Tufts College	94.16
123	Douglas A. Browning	Baltimore College	93.50
97	Raymond J. Reilly	University of Virginia	89.83
114	Bruno Guido Floria	Georgetown University	88.83
117	George Fred Kopf	Georgetown University	88.83
126	Lester Wilson Thompson	Baltimore College	87.83
94	John A. Black, Jr.	University of Virginia	87.67
128	Dr. Solomon S. Kanum	University of Minn. (1932)	87.00
120	Dr. Emanuel Rathsmill	Temple University	86.50
95	Alexander Kaufman	University of Virginia	86.33

The ten highest averages for the Part I and Part II examinations, May 25-26, 1934 were:

Part I

Candidate	Name	School	Grand Average
154	Simon Theodore Chasin	Temple University	95.00
212	Austin J. Rust	Chicago College of Dental Surgery	92.67
175	Claude Rowe Baker	University of Minnesota	91.33
147	Frederick William Oles	University of Michigan	90.83
132	James Merle Martin	Northwestern University	90.17
206	Sidney Charles Liedman	Chicago College of Dental Surgery	90.00
179 Tied for 137 Tied for 221 7	Samuel M. Fasbinder Floyd Bayles Gulick Phillips S. Kanev	Kansas City-Western Dental School Tufts College Dental School Temple University	89.67 89.67 89.67
134 Tied for 201 Tied for 244 10	Dr. Rolland C. Billeter Herman Charles Gornstein Thomas Joseph Campbell	Northwestern University (1932) Chicago College of Dental Surgery Chicago College of Dental Surgery	89.33 89.33 89.33

Part II

117	George F. Kopf	Georgetown University	90.00
123	Douglas A. Browning	Baltimore College of Dental Surgery	89.83
23	Dr. Harold Heckler	University of Minnesota (1922)	89.17
70	Henry L. Boris	Chicago College of Dental Surgery	89.00
85	Lt. F. W. Lepeska (U.S.N.)	University of Minnesota (1921)	87.17
118	William E. Eccleston	Georgetown University	86.83
2 Tied for 63 Tied for 35 7	Dr. L. C. Gyllenborg Gustav S. Goscicki Clifton Benson	University of Minnesota (1922) Chicago College of Dental Surgery University of Pittsburgh	86.50 86.50 86.33
94 Tied for 97 10	John A. Black, Jr. Raymond J. Reilly	Medical College of Virginia Medical College of Virginia	86.17 86.17

The new officers are: chairman, Harry W. Nelson, 1747 Medical Arts Bldg., Minneapolis, Minn.; secretary, Morton J. Loeb, 66 Trumbull St., New Haven, Conn. The new appointees on the board are: Robert R. Gillis, Hammond, Ind., 5-year term as A.D.A. representative; C. Willard Camalier, Washington, D. C., 1 year unexpired term as National Association Dental Examiner; W. F. Walz, Lexington, Ky., 5-year term as National Association Dental Examiners' representative.

The Journal of the American Dental Association

212 East Superior St., Chicago, Ill.

C. N. JOHNSON, Editor

NEWTON G. THOMAS, Associate Editor

Published by the American Dental Association

All expressions of opinions and all statements of supposed facts are published on the authority of the writers over whose signature they appear, and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association.

Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising or business matter should be sent to the Business Manager.

Subscription is included in the annual membership dues. The subscription rate to non-members is $3.50 a year in advance, this rate applying to both domestic and foreign subscribers. All foreign subscriptions are to be paid in United States money.

Editorials

THE QUESTION OF DENTAL CARE FOR THE INDIGENT

The question of dental relief has been much to the fore in recent times, and when we venture the assertion that altogether too much has been made of it, we are not seeking to minimize its importance or to belittle the great need that is involved in its consideration. It is merely to intimate that the demand for dental relief is no new problem, nor does it call for something revolutionary or unique in attempting to bring about a solution. It might be imagined from the hue and cry that has been set up about it that it is a question which is being met for the first time, when, as a matter of fact, the problem has confronted us ever since dentistry had a being. There is a quotation that has been current ever since antiquity to the effect that "the poor always ye have with you," and they have always had to be reckoned with.

The only difference is one of degree, not of essential existence.

The depression made it more acute, and, by the same token, it provided an excuse for relief in too many instances where relief was not indicated.

The one appalling fact connected with this whole question of relief is the demoralization that accompanies it. No one will question the urgent need of relief under certain conditions, and no one will wish to withhold relief when it is legitimately called for. The temper of the American people may be trusted to reach out the helping hand and bring succor to the worthy poor and needy, but be assured of one thing, that bringing relief to people is a delicate and essentially a dangerous business.

The sense of satisfaction that comes to an individual when he is instrumental in relieving suffering is very alluring, and it easily leads men to lending aid when aid is not called for, and when it will do more harm than good. It may seem a harsh doctrine and one unworthy of the better impulses of charitable people to promulgate the principle that dispensing relief should be rigidly restricted to the actual necessities of the case, to the genuinely helpless; but harsh or not harsh, it is fundamental in its equity. To help those who can help themselves is pernicious and harmful.

Look at the whole question of the dole. The moral stamina of the citizens of the world has been seriously impaired by the miasma of the dole. A large part of the people of the earth are in danger of going soft from the demoralization of the dole. Necessary as it may have seemed at the time, it has sapped the vigor and manhood of an appreciable portion of the human race. Able-bodied men by the thousands are living like leeches on the largess of society, when they should be contributing in some measure and through some means to the economic welfare of the world. Talk about the scarcity of work. It is pathetic enough of course, and altogether deplorable, but many of the men who today are declaiming about their inability to find employment would not work if they had it, as long as they can hedge behind the protecting wing of the dole.

It is true that there is a sad maladjustment in our economic regulation or lack of regulation, whereby the needful work of the world is not being performed as it should, and many worthy men

are unable to find work. There is enough work that should be done in improving living conditions all over the world to keep every man busy at profitable employment, but humanity has not yet learned the science of full and adequate living, and, till this is learned, we shall be confronted with the economic imbalance that we see all about us. Mayhap some day we shall learn this lesson, but parenthetically it will come about only when humanity has conquered selfishness in the hearts of the people, and when preparation for war is not the dominant industry of the world. Was there ever a time that the means for making war could not be provided when the machinery of war was once set in motion? Even today, in times of so-called peace, much of the economic substance of the nations is being dissipated and diverted toward preparation for future war, and deliberate propaganda to incite war is being fostered by munitions interests everywhere. When we are faced with such madness in this, the twentieth century, the case seems well-nigh hopeless.

But to revert to our specific problem of dental relief: Much harm has been done through the laudable impulse to bring about relief without sufficient discrimination. Dental relief should be strictly limited to the absolute indigent, and to helpless children. Even so, let us scrutinize a little more carefully the so-called indigent. It is not without reason or precedent to imagine that indigency is sometimes used as a cloak to court relief when there is no legitimate warrant for it, and we cannot affort to countenance such imposition. An emergency has been seized on to institute methods of relief that were supposed to be temporary in character, but which have been blandly warped into a precedent for permanent procedure. Not only that, but the question of so-called relief has been used as a political football to work up propaganda in favor of certain radical ideas that are not conducive to the best interests of the people or the profession.

It is going to be difficult to down this monster of exploitation of the dental profession, and, unless we are alert, we shall have fastened on us a system of dental practice that will not only bring ruin to our individual practitioners, but will also result in inefficient service to the people.

The implication seems to have gone out in certain quarters that members of the dental profession either cannot or will not take the necessary care of the poor and helpless, and that therefore some outside agency should be employed to step into the breach and perform this service. There never was a more baseless or unfair calumny. The time never was and never will be when the profession may be legitimately charged with dereliction of duty when it comes to relief of the needy. Dentists in numberless instances have willingly and even cheerfully given freely of their services under the proper auspices, and they may be depended on to do it again, but, if they are wise, they will not submit to imposition that will not only work a hardship on themselves, but will demoralize the recipients of their bounty. A lack of discrimination in dispensing charity is akin to committing a crime; in fact, it is actually a species of criminality to foster dependence by encouraging an individual to accept something for nothing, or at least without making some kind of a sacrifice in compensation.

Let us revise our ideas and our methods of relief and exact of those accepting our services at least a modicum of reward, be it of whatever character it may. It need not, and in the very nature of things it cannot, always be a material reward, but at least it should involve some kind of restitution, and some sort of recognition of an obligation. To enforce this will not only sweeten the service of the dentist, but will also be more wholesome and salutary for the people served.

THE SOUL OF THE PROFESSION

What is the soul of the profession? Is it that something, intangible or tangible, that places service above material gain, that makes militant battle against any or all of the forces that tend to bring about disintegration or demoralization of our highest ideals, that fights valiantly and willingly in defense of the honor of the profession and in the protection of the material and moral welfare of the people, that looks with zealous eye on the sanctity of human rights, that blinks not at wrong whether it be of an individual or of

a group, that scorns to countenance the creation of place or preferment when there is no warrant or justification for either, that makes no assumption of privileges in excess of equity and justice, that asks for little and grants much, that seeks to give instead of to get—all of these are embodied in what we know as the soul of the profession.

The soul of the profession is constituted of the best traditions of our calling, as exemplified in the aspirations and holy desires of our individual members. The soul of dentistry is represented by the noble impulses and forthright tendencies of dentists. Collectively, we are what we are by virtue of an aggregation of individual units. No man calling himself a dentist can step aside from the ethical path without compromising the profession, and to compromise the profession is to constitute a man something lower than a dentist. It is not only that the man himself is besmirched, but also that reflection is cast on the profession.

The soul of dentistry means something. It means that all down through the ages from the time that some man sought to relieve the pain of toothache, and reached out the helping hand toward friend or neighbor in a crude effort to assuage suffering caused by the tooth conditions, away back beyond medieval days—probably beyond any record made in history—we visualize the presence of pain and the benevolent attempt on the part of some one to relieve it. And ever since that early day, as soon as concerted efforts began to be made to bring system into dental service, we see the genesis of the soul of dentistry, first the halting steps of professional procedure, and then the brave and eager ambition to establish a distinction between the pursuit of trade and the pursuit of a profession; the one concerned merely with the material problem of barter and exchange, the other with the relief of stricken and suffering humanity; the one dealing with commodities and things, the other touching the very mainsprings of human welfare and even human life. The distance between the two is in some respects as wide as the poles; in others, as closeknit and integral as a real brotherhood. We speak of material gain, and at once we think of trade—we speak of sacrifice, and at once we think of professional service.

The soul of a profession is made up of the integration of all of the souls of its individual members, so that what each member does

has a certain bearing on the profession as a whole. If a dentist does a mean or unmannerly act, it places a smirch on the soul of the calling; if a dentist does something noble and uplifting, it exalts the name and fame of dentistry.

The soul of the profession is made up not only of the best traditions of the past; it is constituted of the warp and woof of the every day acts of the present. And it affects all of the members of our craft.

The midnight hour of every noble and self-sacrificing research worker bending over his test-tubes and peering through his microscope, studying the tell-tale evidence of what he sees, and recording his data as religiously as a ritual, forgetting the passage of time, even mayhap the pangs of hunger in his concentration on the finding of a new fact; the patient, gentle practitioner standing at his chair and ministering with solicitous care and faithful mien to the relief of a suffering fellow mortal, soothing the aching nerves and calming the panicky dread of his patients, tenderly bringing relief to the palsied, tremulous miseries of decrepit old age, stooping with gentle concern to quiet the fears and foster the smiles of sensitive, wide-eyed and wondering little children, dedicating with self-sacrificing devotion all of the effort and energy of his existence to the relief of human kind, living a life of self-abnegation and unselfish service that the world may be nobler, and better, and happier—all of this and more is embodied and exemplified in what we call the soul of dentistry.

Without a soul, our calling would be null and void like the cinders and ashes of a desolate waste, like a world without life, like a body without breath; all of the nobler impulses of our better nature barren and bereft, all of the sweetness and light of professional life gone out, all of the hope and cheer dispelled, and the very essence of full and fruitful living banished from our professional ken.

Without a soul, the body is dead. Let us preserve both body and soul by consecration to the noblest aspirations of our lives, and by proving through act and thought, in the face of all of the world, that dentistry has a mission among men—a mission not only of material weal, but of spiritual and emotional devotion—the thing we call the soul of the profession.

INNERVATION OF DENTIN

Sensitiveness of dentin is a daily issue with the dentist, and an annoying one. His technic of treatment begins and ends with the question "What am I treating, nerve terminals or connective tissue fibrils?" This issue was recently revitalized by the appearance of two articles, one by Tojoda, of Tokyo, and one by Münch, of Würzburg, on "Innervation of Dentin."[1] The article is well and clearly illustrated, so well indeed that to eyes not wholly untrained to such observation the illustrations seem to have an air of conclusiveness about them and the whole discussion suggests strongly that a long debate is drawing to an end. Abstracts of the two papers appear on page 2076 of this issue.

The debate on this question has been maintained for almost fifty years, and at times has been definitely other than scientific in its tone and terms. Illustrious names are associated in description of the nerve supply and arrangement of the nerves of the pulp. Many of those names are of workers who were content to rest the question with the description of nerve termini forming plexuses at the pulpal surface or enmeshing the bodies of the odontoblasts. In 1892, the belief was expressed that nerves enter the dentin. Repeatedly, but infrequently, the idea was given support; sometimes with only philosophy to bolster the concept; at others, with results of experimentation. Chief among those who brought laboratory proof was Howard Mummary, in 1902 and 1912. The sensitiveness of dentin kept the issue alive.

All histologists recognized the difficulty of the undertaking. The necessary decalcification of the dentin formed a formidable barrier to success. It and the technic used for demonstrating nervous tissue gave the opposition opportunity to say artefacts, misinterpretation. That same technic or any other equal to the occasion very likely restrained many objectors from attempting a repetition of the test to prove or to disprove. Articles and books came and went, leaving the question dashed over with hypothesis and fancy. It was easier to theorize on the function of the odontoblasts, to assume what the

1. Deutsche Zahnärtzl. Wchnschr., July 13, 20, 1934.

rôle of the dentinal fibrils may be, to support a negative tradition, than to do the necessary critical, painstaking, trying, discouraging work.

The objections made were curiously naive. The dentinal fibril fills the tubule. The odontoblast is a receptor. Its fibrils are capable of nervelike conduction. Sensation is caused by expansion of the fibril. Odontoblasts may have tactile functions. To detract from the excess function accredited to odontoblasts as receptors and conductors, they are denied the duty of dentin formation. In all this, the scientist turned philosophic, ignored tangible technic and ocular evidence and resorted to fancy. A sort of pride bound him to ideas for which no vestige of support could be given except by rationalization, and repudiated the method to which on other counts he was devoted. Finishing a summary, one writer says, "Europe supports innervation; America does not." One textbook alone of all searched accepts the thesis of innervation.

The conservatism manifested is readily understood. The tendency to look askance at any demonstration of dentinal innervation was due to appreciation of the difficulties associated with it. Refusal on the part of objectors, almost guaranteed in the circumstances, had a beneficial result. Only a man who had confidence in his own technical skill would approach it—a superpatient man, one versed in the chemistry involved and alertly understanding the whimsicalities of his material. With the air full of skepticism, he would order his labor with extremest care and strive for unassailable impregnability.

In this last effort, Asia combines with Europe for the assault. To those whose sympathies and convictions are with Mummary and the innervationists, Tojoda comes as a welcome reinforcement. To those who would oppose his statements, his work is a challenge for laboratory proof rather than for an abstract physiology. With innervation of dentin established, the treatment of sensitive dentin assumes a new front. An intelligent, scientific approach becomes possible.

T.

YOU MIGHT DOUBLE YOUR READING

During the lengthening evenings of autumn when the shadows creep in on us almost imperceptibly, there are very few of us who could not increase our reading considerably if we only set ourselves to the task.

Yet we should not state it that way; it should not be considered a task but a privilege to read more books than we do. The amazing indifference to the value of good literature is one of the most inscrutable things in our modern life. Perhaps we would appreciate books more if we had fewer of them. Think of the days when even the kings of the realm had almost no books. It is recorded that King John (whatever we may think of him in history) thought so much of a certain book that he borrowed it from the monastery because he did not possess a copy. A book was a very precious thing in those days. Even as late as Charles Lamb, even as late as Lincoln, a book was a treasure not to be thought of lightly.

We may well have visions of each of these men lugging home under his arm a favorite volume the possession of which has cost him no end of sacrifice not only in effort but also in actual money when money was pitifully scarce. No danger of books not being read when they were so difficult to procure. Books were relished in those days, and they were digested.

Today, with the wealth of literature available for every one, the crying need is for wider and more careful reading, and the autumn months should be the favored time. The long evenings invite the soul of man and beckon him to snuggle up by the fireside and revel in the glory of the best literature.

If every dentist would resolve to read one more book a month, the aggregate increase in knowledge would go a long way toward making our profession a truly learned calling. And there is no excuse for not doing it. The cost would be nominal; in fact, it would be less than nominal for the reason that the best book in our profession may be had for nothing through the medium of the Library of our Association. We feel like pledging our members to the privileges of our Library, where they may borrow a sufficient num-

ber of books to keep themselves informed on the current dental topics of the day.

When these are exhausted, there still remain the numerous libraries of general literature, with such a wealth of material that every one of us can well afford to double his reading.

Obituaries

WILLARD S. BROOMELL, D.D.S.

(1895-1934)

Willard S. Broomell died June 6, after a prolonged illness at his home, 252 W. Hortter Street, Mount Airy, Philadelphia.

He was born in Philadelphia, Sept. 18, 1895. He was graduated from Friend's Central School in 1912 and from the Dental School of Temple University with the class of 1918. During the World War, he served as dental intern in the Pennsylvania Hospital, Philadelphia. After the close of the war, he became associated in practice with his father, I. N. Broomell, dean of the Dental School of Temple University, and was made an instructor in the school two years later. At the time of his death, he was director of the school for oral hygienists.

Dr. Broomell was a member of the American Dental Association, the Pennsylvania State Dental Society, the Academy of Stomatology, the First District Dental Society of Pennsylvania, and the Psi Omega Dental Fraternity, of which organization he was a Past Deputy Grand Master.

He is survived by his father and his widow, Mae Garman Broomell.

STEPHEN DWIGHT HODGE, D.D.S.

(1847-1934)

Stephen Dwight Hodge, known as "the grand old man of dentistry" in Vermont, died September 12 at his home in Underhill, Vt., where he had resided for the past year.

Dr. Hodge was born in Gilmanton, N. H., in 1847. In 1884, he graduated from the dental department of the University of Maryland. He practiced in Vergennes for one year, then came to Burlington, where he practiced until his retirement about ten years ago.

Dr. Hodge was married in 1877 to Miss Lida Mason, who preceded him in death. He is survived by two daughters and a sister.

SAMUEL LAWRENCE SILVERMAN, D.D.S., F.A.C.D.

(1889-1934)

Samuel Lawrence Silverman was born Sept. 16, 1889, in Jassy, Roumania. He came to America as an infant, and lived in Atlanta, Ga., throughout his life. He died after a major operation performed in an effort to save his life. Departing in the prime of a highly successful and illustrious career, he will long be remembered by his countless friends and associates in the dental profession.

Dr. Silverman was graduated from the Southern Dental College, Atlanta, in 1910, as valedictorian of his class. Early in his career, he became interested in the specialty of oral surgery, beginning his study under the late Truman W. Brophy. Shortly after his graduation, he became professor of anesthesia and assistant professor of oral surgery, later becoming professor of the latter subject. His aptitude in his chosen field approached genius and his practice grew to large proportions. In addition to his teaching duties in the Atlanta-Southern Dental College, he was special lecturer in oral surgery in the medical school of Emory University and a member of the staffs of Grady and Piedmont hospitals and St. Joseph's Infirmary, oral surgeon at the Scottish Rite Hospital and consulting oral surgeon for the Warm Springs Foundation, at Warm Springs, Ga. At one time, he served as special lecturer on oral surgery at Columbia University.

Dr. Silverman was the author of a textbook entitled "Principles and Practice of Oral Surgery," which has not only enjoyed wide favor in America, but has also been translated into several foreign languages. This book is distinguished by its lucid, direct mode of statement—a characteristic which Dr. Silverman displayed also in his lectures to students. Forceful simplicity, intelligent understanding and an eagerness for things intellectual were dominating traits in his personality, not only in the class room, but in social contacts as well.

Innumerable honors came to Dr. Silverman from his profession during his short, almost meteoric career. Dying at the age of 45, when most men are just beginning to find themselves, he had already received recognition which very few are fortunate enough to achieve in a lifetime. He was a fellow of the American College of Dentists, a past president of the Fifth District Dental Society of Atlanta and a member of the honorary dental fraternity, Omicron Kappa Upsilon. He was a member of the American Dental Association and of the Psi Omega Dental Fraternity. He appeared as lecturer and clinician before numbers of dental and medical societies in foreign countries, including France, Germany and Mexico. He was one of the first oral surgeons in the United States to utilize procaine anesthesia in practice, having introduced it approximately twenty years ago in the South.

Dr. Silverman had been one of the directors of the Thomas P. Hinman Midwinter Clinic since its beginning in 1914. He was a lover of sports, literature and music and the other arts. His zest for living and his appreciation of the subtler things of life, combined with a natural, unaffected friendliness, endowed him with a personality so warm and rare that it is hard to think of such a brave, cheerful spirit as having passed on. Notwithstanding his eminence as a scientist, his associates will remember him most vividly as a valiant, sympathetic and lovable friend.

Dr. Silverman never married. He is survived by his mother, Mrs. Sophie Silver-

man, and two sisters, Misses Laura and Janice Silverman, all of Los Angeles, and two brothers, Max H. Silverman, Tulsa, Okla., and Dr. Jack Silverman, of Los Angeles.

SHEPPARD W. FOSTER.

GUY F. CORLEY, D.D.S.

(1881-1934)

Guy F. Corley died suddenly September 28 in his office in Mattoon, Ill.; aged 53.

Dr. Corley was born Oct. 6, 1881, in Tower Hill. After his graduation from high school, he entered the Chicago College of Dental Surgery, where he was graduated in 1902. He entered the office of S. A. Campbell, of Mattoon, and later opened his own office.

Dr. Corley was president of the Eastern Illinois Dental Society, 1933-1934, a member of the Illinois State Dental Society and American Dental Association and of the American Society of Orthodontists. He served as president of the school board for eight years.

Dr. Corley married Miss Zelpha Young in 1912, who died in 1918. In October, 1933, he married Miss Margaret McCrory, of Charleston, who survives him, together with one brother and a sister.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Hot Water and Sterilization—I tried other methods of heating water for a long time, but my electric water heater and electric sterilizer are "just right." Electricity is a clean and prompt servant.—*Ryland O. Sadler, Baltimore, Md.*

Curve of Spee—The deciduous dentition has no curve of Spee. It does not begin to form until the age of transition from the mixed to the adult dentition, at which time there is a marked acceleration of vertical growth of the jaws, face and all the teeth.—*Frank A. Delabarre, Boston, Mass.*

Law of Arrangement—With the new forms of posterior artificial teeth at our disposal, the old law of arrangement affecting the placement of the anterior teeth is doubly important. "The lower incisor teeth shall be clear of the upper ones by nearly one sixteenth of an inch."—*E. C. Pendleton, Chicago, Ill.*

Care for the Breath—It often requires years to determine a dentist's real ability, while only a few minutes to discover a breath that is unpleasant. Invariably, mouth wash should be used before every operation. Personality, ambition, a good breath and

skill in the order named are essential to a successful dental career.—*Herbert Ely Williams, Red Bank, N. J.*

Polishing Wax Models of Inlays—After the wax is carved to form, and smoothed, the occlusal and proximal surfaces of the wax may be given a high polish with a pellet of cotton held in the pliers and dipped in vaseline. The vaseline used in this way will impart a beautiful polish without distorting the wax model or impairing the margins. Before inserting the wax, it should be cleaned with alcohol. An inlay cast from a model of this kind will need little finishing.—*Technician.*

Proper Adjustment of Dental Chair—Most dentists work with the dental chair too nearly upright. The more the chair is tilted back, the less the dentist must tilt forward, especially when working behind the patient. The manufacturers made the tipping position for the permanent benefit of the dentist rather than the temporary comfort of the patient. The eye and ear man sits down at his work, for steadiness. The sitting posture is to be advocated and the tilted chair position is a conserver of both energy and time.—*Herbert Ely Williams, Red Bank, N.J.*

Preparation of Papers for Publication—First the title—next the headings—write copiously and in detail—condense at least one half—read the paper aloud to your wife—condense some more—let the manuscript rest at least a week—read again and condense—when all verbiage is eliminated, have the manuscript typed—use good manuscript paper, not thin onion skin—have it typed double space—make at least one carbon copy for your files—after the paper is read send the original to the chairman of the program committee—if paper is not to be presented before a society send it to the editor—then be patient, the editor may not be able to pass on the paper within an hour or two of the time it is received. If you fulfil these conditions the probability is that your paper will be accepted.—*Editor.*

Impaction of Teeth—The impaction of teeth is a question of major importance, particularly in the case of third molars. There is a great probability of upsetting an otherwise good occlusion owing to the constant effort to erupt in a restricted area and also the danger of pathologic complications, severe in character. Even if these do not occur, there remains the much graver possibility of nervous reflexes, attributed to the repeated peripheral irritation, with no localized pain. These may be so apparently insignificant that the decision to "let well enough alone" is often advised. The cumulative effect is lost sight of and the final outcome is frequently exhibited as chorea, some forms of epilepsy or even dementia precox. The logical conclusion is that it should be routine procedure to take yearly roentgenograms for every young adult, as a basis of diagnosis, at or before the period of eruption.—*Frank A. Delabarre, Boston, Mass.*

Space Retainers—The use of space maintainers is indicated in all cases of premature loss of the deciduous molars, occurring more than a few months before the successors are due to erupt. They can even be used to advantage if the second deciduous molar is lost, just prior to the eruption of the first permanent molar, with a distal spur disappearing in a surgical incision and engaging the mesial surface of the unerupted first permanent molar. A roentgenogram is, of course, indicated prior to the operation. Stanton has shown that, without such procedure, the first molar may

drift forward 5 mm. in a few months before eruption. Forward drift of molars introduces a most severe complication in the treatment of malocclusion. Wherever possible, the appliance should be designed, not only to maintain the space, but also to provide a degree of function to prevent the opposing teeth from elongation.—*Frank A. Delabarre, Boston, Mass.*

Temporary Protection in Porcelain Jacket Crown Work—After the impression has been taken for a porcelain jacket crown, the ground stump must be protected during the construction of the crown. Ordinarily, silicate cement is used to build a temporary crown, and sometimes small particles of the silicate are left adherent to the junction between the shoulder at the gum and the tendon when the silicate is removed. The smallest particles thus adherent interfere with the accurate fit of the porcelain, and it is always better to avoid forcing the silicate into this joint. This can readily be done by placing around the shoulder a ring of temporary stopping, not more than a millimeter or two in diameter, and building the silicate over it. When the silicate is removed for placing the porcelain jacket, the temporary stopping will come away with it leaving a perfectly clean shoulder ready for the reception of the crown.—*Editor.*

Dentures or Plates?—When Goodyear accidentally discovered the hardening process of rubber, he became dentistry's great benefactor. Rubber will always occupy a valuable place in prosthetic endeavor, but that is not the stopping place. There are too many other useful materials which years ago were not thought usable. I inserted upper and lower partial gold dentures for a refined, rather reserved lady, with carefully printed booklet as to proper denture care. She was told of the dentist's joy at making such fine dentures, because patients show them to their friends. A short time thereafter, at a bridge game, the relative merits of the various local dentists were discussed. A "showdown" resulted and the patient removed her glittering gold dentures and exhibited them to the others, who all wore rubber plates and not very nice ones at that, because they probably would not let their dentist do his best. That is one difference between plates and dentures: dentures are shown—plates but seldom.—*Herbert Ely Williams, Red Bank, N. J.*

Lower Dentures and Calculus—Most undesirable is tenaciously clinging tartar on the lingual aspect of the lower plates. Patients often associate its presence with inferior materials. If it is necessary to remove calcific deposit from natural teeth semi-annually, lower plates should be constructed as nearly tartar proof as possible. Nowadays, "it is not all gold that glitters" within the realm of dental materials; many are new alloys of old metals. Almost forgotten are Weston's and Watts' low heat casting alloys, which can be poured like water. Olden times found them useful in stabilizing through added weight. Today, they make a most desirable lower cast base upon which vulcanite attachments rest most appropriately. These metals may be cast much thinner than one would think; which will deter plate-fracturing patients, who are chronic wreckers of lower dentures at the median aspect. The casting should extend nearly to the lingual tooth pins, a region where tartar collects. Rubber boots are hot to wear in summer; rubber plates are hot the year around. So much, then for Weston and Watts, synonyms of cleanliness and coolness.—*Herbert Ely Williams, Red Bank, N. J.*

COUNCIL ON DENTAL THERAPEUTICS

Inquiries have come to the Council concerning the treatment of hypersensitive dentin, with special reference to drugs which may be used for that purpose. The following paper is an example of one approach to the treatment of this condition. While the Council approves of the statements made therein, the statements are made on the responsibility of the author. A more detailed consideration of the subject of this report will appear in a forthcoming issue of THE JOURNAL in a paper by Dr. Grossman. The Council has authorized publication of the following report as one of its series of articles on pharmacology and therapeutics.

SAMUEL M. GORDON, *Secretary.*

THE TREATMENT OF HYPERSENSITIVE DENTIN

By LOUIS I. GROSSMAN, D.D.S., Philadelphia, Pa.

Hypersensitiveness of dentin implies an uncommonly sensitive or painful response of the exposed or partially exposed dentin to an irritation. This includes dentin exposed by caries, by attrition, abrasion or erosion, by failure of the enamel to meet the cementum and by marked atrophy of the alveolar process, exposing both dentin and cementum. The treatment of hypersensitive dentin commonly found in carious cavities will not be discussed here other than to mention that a glycerinated solution of phenol and potassium hydroxide as suggested by Robinson[1] in 1888 may be used for this purpose.

A medicament for treating hypersensitive dentin should (1) not unduly irritate or endanger the pulp; (2) be painless on application, or shortly afterward; (3) be easily applied; (4) be rapid in action; (5) be permanently effective, and (6) not discolor tooth structure.

Practically all the medicaments used in the treatment of hypersensitive dentin are caustics. Solutions of potassium or sodium hydroxide, and nonself-limiting drugs such as zinc chloride, paraformaldehyde or arsenic trioxide are potentially dangerous agents, as they may destroy the pulp. The following drugs, intelligently applied, may be used safely: (1) silver nitrate, (2) solution of formaldehyde and (3) sodium-potassium carbonate.

In general, the method of treatment may be divided into: (1) preparation of the hypersensitive area; (2) application of the medicament, and (3) protection of the hypersensitive area.

PREPARATION OF HYPERSENSITIVE AREA

The preparation of the hypersensitive area before application of the medicament is usually inadequate. It is absolutely necessary to rid the hypersensitive area of its coating of food débris, fatty matter, mucin, etc., in order to expose the dentinal fibrils to the action of the medicament. Unless this is done, the best medication may fail. The tooth should first be cleansed with a pumice paste. A coarse abrasive that washes away readily and the particles of which are too large to clog the dentinal tubules is preferable to a fine abrasive, which is more adherent to the tooth surface and may choke up the orifices of the tubules.

1. Robinson, J. A.: D. Items Int., 10:466 (Oct.) 1888.

After a thorough cleansing, the teeth are syringed or sprayed with warm water to wash away the abrasive and any remaining foreign matter. The teeth in the affected area are isolated with a rubber dam or cotton rolls and the tooth to be treated is thoroughly dried with cotton and warm air. Where the rubber dam cannot be used and there is a profuse flow of saliva which hinders the work, one-one hundredth grain atropine sulphate may be given the patient three hours and again an hour and a half before treatment. The exposed hypersensitive dentin is then swabbed thoroughly with a benzyl alcohol-choloroform solution (equal parts), or else with pure benzyl alcohol followed by chloroform. After this preparation, the dentinal surface is ready for the application of the medicament.

MEDICATION

Silver Nitrate.—Silver nitrate can be used in posterior teeth on the cementodentinal surfaces which have been exposed by gingival and alveolar atrophy; in anterior teeth, on the lingual surfaces and on abrasion or erosion areas on the buccal or labial surfaces of teeth, provided there is no esthetic objection. Silver nitrate should not be used where only a thin layer of dentin covers the pulp as it might penetrate into and destroy the pulp. It should also not be used where the decided black stain which it produces is objectionable.

Silver nitrate is the most effective drug for the treatment of hypersensitive dentin. It produces its effect by causing a superficial destruction of the protoplasm in the dentinal tubules. At the same time, it forms a more or less solid precipitate which effectively shuts off the dentinal fibrils from external irritation. Its penetration is not deep, being self-limiting in its action, but is nevertheless sufficient to be effective.

Ammoniacal silver nitrate is preferable to a plain silver nitrate solution because it is more readily reduced. It is prepared by adding to a saturated solution of silver nitrate U.S.P. strong ammonia water U.S.P. until the solution becomes turbid, then clears again. The ammonia water should be added slowly, drop by drop, and discontinued instantly the solution becomes clear, since an excess of ammonia leads to undesirable irritation. (Gordon and Shand.[2])

Reduction of silver nitrate is accomplished by exposure to strong light followed by the application of eugenol. A photo-flood lamp mounted in a reflector is recommended for a concentrated source of light. This lamp has a 750-1,000 watt capacity and gives an even, diffuse, strong light. The light should be held 1 or 2 feet away from the patient's face and the patient's eyes should be protected from the strong glare. In the treatment of posterior teeth or distal surfaces of teeth, the light can be reflected by a mouth mirror. In about one minute, the silver is partially precipitated from the silver nitrate solution. A small pledget of cotton charged with eugenol is then applied for from one to two minutes. When the hypersensitive area turns a deep black, it is thoroughly dried with cotton and warm air. It is then ready for the third stage of the technic, which will be discussed later. A solution of sodium chloride (table salt) should be on hand to neutralize the effect of any accidental contact of the silver nitrate with the soft tissues.

Solution of Formaldehyde.—On the exposed surfaces of anterior teeth and where for esthetic reasons a nonstaining agent is necessary, solution of formaldehyde is the medicament of choice. It is particularly indicated in hypersensitive decalcified areas on the labial surfaces of anterior teeth which do not require filling; in abrasion or erosion cavities which are not deep, and where the enamel and cementum do not meet, the dentin being thus exposed. Solution of formaldehyde should be used where the rubber dam can

2. Gordon, S. M., and Shand, E. W.: Ammoniacal Silver Nitrate, J.A.D.A., 20:530 (March) 1933.

be applied so as to protect the gingival tissue from its destructive effect. It should not be used where the dentin covering the pulp is thin, nor in deep erosion cavities, nor in cases of marked attrition where it may endanger the pulp.

Solution of formaldehyde is preferably applied with an orangewood stick which has a beveled edge like that of a hypodermic needle, similar to those available for prophylactic work. The formaldehyde solution is not only applied to the hypersensitive area, but also should be rubbed with some pressure over the affected surface. In addition to favoring a more intimate contact of the formaldehyde with the dentinal fibrils, a certain amount of warmth is created by the friction, which facilitates penetration of the drug. The formaldehyde should be applied in this manner for about five minutes. Where it is not possible to burnish the formaldehyde over the dentinal surface, a blast of warm air from a chip syringe may facilitate its penetration.

After the formaldehyde solution is applied, the gingiva should be washed lightly with ammonium acetate solution U.S.P. This will neutralize the effect of any accidental contact of the formaldehyde with the gum tissue.

Sodium-Potassium Carbonate.—Sodium-potassium carbonate in the form of a paste for desensitizing dentin was suggested by Prinz[3] about ten years ago. It does not stain tooth structure. It is especially indicated where the dentin overlying the pulp is relatively thin, since it does not penetrate deeply. It may be used especially in hypersensitiveness due to attrition, erosion or abrasion, and when a relatively nonirritating caustic is desired. It is contraindicated in those areas of the mouth where it cannot be burnished over the exposed dentin with an engine burnisher or orangewood stick. It is not so useful for desensitizing a narrow strip of dentin exposed between enamel and cementum, or in desensitizing distolingual or distobuccal areas of teeth. Because of its mild effect, it is not so necessary to protect the soft tissue by means of a rubber dam.

Sodium-potassium carbonate is made into a paste by triturating in a mortar 1 part sodium carbonate C.P. crystals with 4 parts potassium carbonate powder U.S.P. This should be preserved in a well-stoppered bottle after the addition of a few drops of glycerine to maintain the consistency of the paste. After the hypersensitive area has been prepared, the paste is applied to the affected area and burnished over the surface with an engine burnisher. This facilitates penetration by bringing about a more intimate contact of the drug with the exposed fibrils. After about five minutes of burnishing, during which intervals of rest must be allowed so as not to overheat the tooth, the area is dried with cotton and a protective varnish is applied.

PROTECTION OF THE HYPERSENSITIVE AREA

It has been observed that when a protective medium such as a varnish is applied to a hypersensitive area immediately after medication, a more certain desensitizing effect is obtained. Whether the varnish fixes a minute quantity of the medicament to the dentinal surface and thus prolongs its action or the varnish reduces irritation by acting as an insulator is uncertain. The protective effect has been observed often enough to warrant its use. For this purpose, a gum copal varnish or the following may be used: gum mastic, 1 part; gum sandarac, 4 parts; alcohol, 16 parts.

Temporary attacks of hypersensitiveness of the dentin such as those which occur after eating citrus fruits or during states of lowered vitality or mental distress, menstruation or pregnancy or infection of the upper respiratory tract may be relieved by the use of a warm alkaline mouth wash. As a rule, a mouth wash is ineffective for genuine, continued states of hypersensitiveness.

3. Prinz, Hermann: Diseases of Soft Structures of Teeth and Their Treatment, Philadelphia: Lea & Febiger, 1928, p. 96.

For the treatment of that painful condition of the dentin commonly known as "hypersensitive dentin," the method outlined above should prove effective. It must be emphasized that the three stages of treatment are interrelated and necessary and on the careful execution of each part will depend the success of the treatment.

STERIDENT NO. 1, STERIDENT NO. 2, STERIDENT "D" AND STERIDENT PIMENTO EUGENOL— NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Steridentis the name under which the King's Specialty Company, of Fort Wayne, Ind., sells to the dental profession a series of preparations "for preserving pulp vitality and sterilizing infected dentine." Steridentis stated to consist of two powders and one liquid. One powder is stated to consist of "magnesium zinc," the other of the same, with the addition of silver nitrate. The liquid is pimento eugenol.

"The one containing Silver Nitrate is used when the cavity approaches the pulp, more especially in cavities in teeth distal to the cuspids. The plain is used when the cavity is not deep and all discolored dentine has been removed, or in a very thin anterior tooth where a dark shadow might result from using the Silver Nitrate."

Steridentis D, which is said to be Steridentis No. 1 to which a surplus of silver nitrate has been added in order to make it more effective, seems to be advertised for use in deciduous teeth and in the first and second permanent molars.

A frank statement of composition does not appear on the label. The firm was requested to furnish a statement of qualitative and quantitative composition, but they did not avail themselves of the opportunity to place this information on record. Indeed, the firm has consistently refused to cooperate with the Council and with the dental profession by frankly revealing the composition of several of its trademarked preparations. This policy is contrary to the interests of the profession and the public, for it is not only the right but also the duty of the members of the profession to know what they use or prescribe.

The A.D.A. Bureau of Chemistry, after examining the products, concluded that these products may be simulated as follows:

Pimento eugenol will do no more, no less, than eugenol U.S.P., when used as directed.

Steridentis No. 2 is essentially zinc oxide.

Steridentis No. 1 may be simulated by mixing together 97 parts by weight of zinc oxide U.S.P. and 3 parts by weight of silver nitrate U.S.P., and, on the whole, is similar to a product sold under the name of Carbol Eugenol S Powder previously reported on by the Council.[1]

Steridentis D may be simulated by mixing together 80 parts by weight of zinc oxide U.S.P., and 20 parts of silver nitrate U.S.P.

It is apparent that the cost of these materials under the name of Steridentis far greater than the cost to the dentist of virtually the same products compounded from known and readily available ingredients.

It is not necessary here to repeat the Council's suggestions concerning drugs for pulp capping that have already appeared in the report on Carbol Eugenol further than to remind the profession again that pulp capping is a commonly practiced procedure in

1. Carbol-Eugenol S Powder—Not Acceptable for A.D.R., J.A.D.A., 21:1694 (Sept.) 1934.

dentistry, and that readily available materials have been successfully used at a great saving and with satisfactory results in the past.

In view of the foregoing, Steridents No. 1, Steridents No. 2, Steridents D and Steridents Pimento Eugenol are declared inadmissible to A.D.R. because: (1) a frank statement of composition does not appear on the label and the composition is secret (Rule 1); (2) tests for identifying the ingredients are not made available (Rule 2), and (3) no evidence is available that Steridents products possess advantages over zinc oxide and eugenol alone, or a mixture of zinc oxide and silver nitrate and eugenol, and the firm is not entitled to a proprietary name for a mixture of well-known substances (Rule 8).

ROXAN FOR PYORRHEA—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Roxan for Pyorrhea is a product marketed by the Roxan Drug Company, Inc., of Wheeling, W. Va. An 8-ounce bottle sells for $1.50. A dentist in Ohio requested that an examination and a report be made on the product as "this company is jeopardizing the profession in Ohio Valley."

There was sent to the Council a testimonial signed by one "Hoy B. McCuskey, D.D.S.," from the dental clinic of the West Virginia State Prison. The testimonial follows:

> For the past few years the Dental Profession has been swamped with numerous drugs to be employed in the treatment of pyorrhea and the different mouth conditions—I was skeptical of "Roxan"—but decided to give it a trial in our clinic. Without doubt it has proven to be the best drug or remedy for the treatment of "Trench Mouth" (Our cases are stubborn due to the many months the inmates spend in the county jails before their entry into the institution) we have ever used.
>
> I am glad to give this testimonial to you—Our cases are under constant observation and the treatment given without any variation in appointments. If those who use Roxan will be as faithful in their treatment—I am sure they will get the same results as we get.
>
> (End of testimonial)

No statement of composition appears on the label, nor does the information to indicate its usefulness in specially diagnosed cases of gingival disease appear on the label or in the literature available on the product. Accordingly, the product was submitted to the A.D.A. Bureau of Chemistry with a request for examination. The chemist's report follows.

CHEMIST'S REPORT

One original sample of Roxan for Pyorrhea (Roxan Drug Company, Inc., Wheeling, W. Va.), price, $1.50, received from a correspondent was examined.

The following appeared on the label:

> A Safe Preparation for the treatment of Pyorrhea, Bleeding, Spongy, Painful or Diseased Gums.

The bottle contained 230 c.c. (approximately $7\frac{2}{3}$ fluid ounces) of a murky, dark brown liquid, in which a brown sediment appeared. It had a sour odor, salty taste and slight astringency. On shaking, a slight foam formed. Crystals having the cubical structure of sodium chloride appeared in the bottle from which the material had been drained. The odor was suggestive of sour fruit. The liquid was markedly acid to litmus, and the specific gravity was 1.118 at 23 C.

Qualitative tests indicated the presence of sulphate, chloride, tannin-like material, reducing agents, probably glucose, aluminum, calcium, sodium and free acetic acid.

Quantitative determinations yielded the following:

Total solids	18.63 gm. per 100 c.c.
Suspended solids	0.06 gm. per 100 c.c.
Ash (600 C)	14.96 gm. per 100 c.c.
Sulphated ash	18.31 gm. per 100 c.c.
Chloride (Cl^-)	8.25 gm. per 100 c.c.
Sulphate ($SO_4^=$)	1.29 gm. per 100 c.c.
Aluminum (Al^{+++})	0.16 gm. per 100 c.c.
Volatile matter as acetic acid	2.54 gm. per 100 c.c.
Sodium (Na^+)	5.68 gm. per 100 c.c.

By calculating the chloride to sodium chloride (salt) and assuming the aluminum and sulphate (SO_4) to come from a preparation such as aluminum subacetate (N.F. V), it may be determined from the foregoing that Roxan for Pyorrhea is essentially a 14 per cent solution of salt and a dash of solution of aluminum subacetate (N.F. V) in a murky liquid suggestive of sour apple cider, or other fermented fruit juice.

A solution corresponding in some of its physical and chemical attributes to Roxan for Pyorrhea was prepared by dissolving 27 gm. of salt, 23 c.c. of solution of aluminum subacetate (N.F. V) in sweet apple cider, to make 250 c.c. and allowing to stand for some time. The prepared solution has a specific gravity of 1.118 and responds to tests with Fehling's solution, ferric chloride test solution, barium chloride and silver nitrate. After the solution stands for some time, the color and sediment approaches that appearing in Roxan.

(End of Chemist's report)

The chemist's report shows that Roxan for Pyorrhea is essentially a 14 per cent solution of salt and a dash of solution of aluminum subacetate in a murky liquid suggestive of fermented fruit juice. How such a mixture can be regarded as a safe preparation for the treatment of pyorrhea remains to be proved.

In view of the foregoing, the Council declares Roxan for Pyorrhea inadmissible to A.D.R. because a statement of composition is not furnished on the label (Rule 1); it is sold directly to the public for the treatment of gum diseases that require competent diagnosis and attention (Rule 3); it is marketed with unwarranted therapeutic claims (Rule 6), and the name is not indicative of the composition and the Council cannot recognize a proprietary, nondescriptive name for a mixture of well-known substances (Rule 8), which is an unscientific mixture, the use of which cannot be considered in the interest of the profession or of the public.

Therapeutic Evidence: Its Crucial Test.—According to the good old truism, the last and crucial proof of the pudding is in the eating thereof; and so, the last and crucial test of a therapeutic agent is its consumption by a patient. There is, however, one essential difference: When the pudding is eaten, with a sense of satisfaction, we know that it was a good, or at least an eatable, pudding. If the patient improves after taking a remedy, we do not yet know that he improved on account of the remedy. The *post hoc* type of reasoning or logic is not respectable; but it is all too apt to creep in unawares, unless one takes great precautions indeed. Clinical evidence needs especially to be on its guard against this pitfall, for the conditions of disease never remain constant; nor is it possible to foresee with certainty the direction which they are going to take. It is just this point which makes the clinical evidence so much more difficult to interpret than laboratory evidence, in which the conditions can be more or less exactly controlled, and any changes foreseen. It is on this account, also, that clinical experiments must be surrounded with extra painstaking precautions.—Torald Sollman.

HELPING THE COUNCIL TO *HELP DENTISTS*

Few dentists can afford the time or have the all-around knowledge of Chemistry, Bacteriology and Pharmacology necessary to pass judgment on each of the proprietary remedies they are asked to use or prescribe.

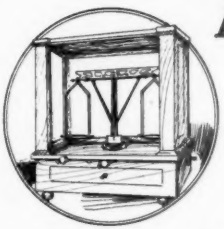
THE COUNCIL ON DENTAL THERAPEUTICS IS COMPOSED OF EXPERTS IN THESE FIELDS, AND IT HAS THE AID OF THE A·D·A BUREAU OF CHEMISTRY (AND THE COOPERATION OF INDEPENDENT SCIENTISTS AS WELL) NECESSARY TO EVALUATE PROPRIETARIES FROM EVERY POINT OF VIEW.

THE COUNCIL GIVES THE DENTAL PROFESSION UNBIASED INFORMATION ON PROPRIETARY PREPARATIONS WORTHY OR OTHERWISE

Dentists will help the Council to help themselves by following the reports of the Council to appear in the Journal.

This and the chart on the opposite page are part of an exhibit of the Council on Dental Therapeutics presented at the St. Paul Session, Aug. 6-10, 1934.

LABORATORY TOOLS
AND METHOD



The work of the
A.D.A. BUREAU OF CHEMISTRY IS done in a well-equipped laboratory.

Volumetric, weighing, and temperature apparatus is standardized by the Bureau of Standards.

Reagents are prepared on the U.S.P. basis.

All drying and ashing determinations are done under carefully controlled conditions.

All determinations are made in duplicate.

Whenever possible, more than one analytical method is used as a check.

THE BUREAU SAFEGUARDS the interests of dentists by safeguarding its work.

BUREAU OF PUBLIC RELATIONS

CONDUCTION ANESTHESIA FOR CHILDREN*

By JOSEPH B. SHERMAN, D.D.S., Chicago, Ill.

BY reason of the great improvements that have been made in anesthetic solutions, technic and instrumentation for local anesthesia, the extraction of teeth has become practically painless. Owing to this improvement, patients are quite often too willing to have teeth extracted. How often have we heard the patient say, "Doctor, I would rather have this tooth extracted than to have you use that drill." Such being the case, it is time that we broaden the field of use for local anesthesia to include those operations involving extensive preparation of teeth, of which the patient stands so much in dread.

Conditions often force one to employ methods that may have seemed, at some time or other, impossible. I found this to be true in the management of children who were presented at one of our Chicago Board of Health dental dispensaries. Previous to my taking charge of this dispensary in 1928, a large majority of extractions of permanent teeth were referred to other dispensaries, in which gas was administered. This was not altogether satisfactory, for these dispensaries were crowded and often scheduled cases weeks ahead. Also, there was the likelihood that cases referred to other agencies for extraction would never be completed once they passed from my control.

Owing to the confusion and noise and its consequent bad effect on those children who were awaiting treatment, it was evident that some method had to be employed which would not only minimize the confusion, but also enable us to perform quickly and efficiently the vast amount of work which was coming into the dispensary. Those of you who have handled children have a definite idea of the nervous strain involved in handling ten to sixteen children a day.

Conduction anesthesia had not been a matter of regular procedure in the dispensary. Therefore, contrary to many adverse opinions expressed by several of my older friends in the profession, we decided to make local anesthesia, especially the conductive branch, a matter of routine procedure. The results obtained in the handling of more than 2,500 completed cases in more than 10,000 sittings in the past six years have more than warranted our expectations, and to us have proved the safety and feasibility of the plan.

On account of the difference in the bony structures of the maxilla and mandible, it is comparatively easy to obtain satisfactory anesthesia for operative work in the maxilla. Therefore, I shall confine myself to visualization of the mandible as seen most frequently in my work

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

with the Chicago Board of Health. There is the case often presented of one side of the lower jaw in a child about 8 years of age: a cavity in the distal surface of the deciduous cuspid and the first and second deciduous molars so badly broken down or abscessed that they have to be extracted. There are deep occlusal cavities in the first permanent molars, or they may even have to be extracted. If the first and second deciduous molars do not have to be extracted, it is not unusual to find that they require two or three mesioclusal or distoclusal fillings or possibly two mesioclusodistal fillings.

The belief is often expressed that an operator might expose the pulp or generate sufficient heat to destroy the vitality of the tooth when using a local anesthetic; that he will not be guided in his procedure by such evidences of pain as would be shown by the patient if there were no anesthesia. The fact that there is no sensation in the part does not mean that the operator can attack the work in a ruthless manner. If it were true that evidence of pain was necessary, the skilful fingers of the surgeon operating under comparable conditions are but fumbling in the dark. He can be guided solely by his knowledge of anatomy, and so it should be with the dentist. The dentist must have a thorough knowledge of the anatomy of the tooth so that he will know just how far to excavate or to what degree drilling can be safely accomplished. On the other hand, is it not quite likely that cavities are often underprepared without the use of an anesthetic, especially when we are receiving no cooperation from the patient? With the use of an anesthetic, it would be much easier to carry any cavity preparations to its proper limits, thereby eliminating all underpreparations.

Braun, in describing the correct technic for conduction anesthesia, says, "Its greatest difficulty consists in its description." These are the anatomic landmarks and technic by which we are guided in the injection. In children between 4 and 12 years of age, as the muscles and mucous folds of the retromolar triangle area are not so highly developed as in an adult, it is easier to determine this area between the external and internal oblique lines, on the anterior border of the ascending ramus. The index finger is used for palpation, and with the bulbous tip to the outside, remains stationary in the retromolar triangle to help guide the insertion of the needle at the inner border of the ascending ramus, above the lingula, and approximately three-eighths inch above the level of the occlusal surfaces of the molars.

In the straight line technic used, the barrel of the syringe will be about on a line with the cuspid of the opposite side of the mandible. This technic is favored because once the point of the puncture is determined, there is no lateral movement of the syringe by which the needle might be bent or broken.

By proper placement of the fingers during the injection, using a short 2 c.c. cartridge type syringe and a No. 3 25-gage needle, one is able to secure a greater amount of stability than by using a long syringe and a needle that is longer than necessary. The pistol grip employed leaves the index finger free to guide the direction of the injection and stabilize the syringe against any sudden or unlooked for movement. One cubic centimeter of 2 per cent procaine, a 1:50,000 solution, is sufficient for anesthesia in the large majority of cases. This 1 c.c. of 2 per cent procaine, 1:50,000, contains one thirty-two-hundredth grain of epinephrine and one-third grain of procaine.

By reason of the immaturity of the child's mandible, the needle should be directed slightly downward in its course

close to the inner surface of the ramus. At the point of greatest depth of the injection, which averages about one-half inch for children between 4 and 12 years of age, the major portion of the solution is slowly deposited in a space above the mandibular foramen, known as the pterygomandibular space. The mandibular nerve enters the mandibular foramen on the inner surface of the ramus and proceeds forward to enervate all the teeth on one side of the mandible. At approximately the point of entrance of the mandibular nerve, the conductivity of this nerve is intercepted by the solution to bring about anesthesia of one-half the lower jaw.

The pterygomandibular space, filled with loose connective tissue having a great avidity for the anesthetic solution, lies somewhat below the superior border of the lingula, a bony projection guarding the mandibular foramen. In adults, as this space lies on a line with or somewhat above the superior surface of the lingula, it is quite evident that the slight downward inclination of the needle constitutes an important variation in the technic as employed for adults. Another important variation, of course, is the depth of the injection.

About three minutes after the injection, the child will be aware of a slight tingling of the lower lip and the tongue on the injected side, and will probably complain that his lip feels swollen; whereupon, he is assured that the swollen sensation is only temporary and will pass away shortly after the work has been completed. He is also informed that, by reason of this peculiar feeling, the grinding or extraction can be completed without pain. Difficulty in deglutition or the presence of ankylosis indicates that the injection did not closely follow the inner surface of the ramus, but went too far pharyngeally and posteriorly.

If the needle is directed along the lateral surface of the lingula instead of its superior border, the needle will be deflected by this bony promontory into the fibers of the internal pterygoid muscle, with a consequent trismus of the muscle and absence of anesthesia in the field desired. With practice, the operator will be able to sense the fact that he is proceeding in the wrong direction, whereupon the needle can be wholly or partially withdrawn to correct the line of injection.

One argument advanced against conduction anesthesia for children is that it is dangerous. If pressed for an explanation as to what is meant by dangerous, one receives the impression that any injection that might be termed a deep injection is a dangerous procedure for children. Of course, it must be taken for granted that the operator has a thorough knowledge of the anatomy of the area of injection, and that his instrumentarium is well selected. We have proved to our own satisfaction that the danger arising from moving of the head during the injection can be greatly minimized by the use of a topical anesthetic prior to the injection. This one puncture is made in comparatively loose or soft tissue with less discomfort than the child would be subjected to in infiltration around the tooth or teeth involved. No punctures are made on the lingual aspect, as these, when employed in infiltration, are always a source of great discomfort owing to the density of the tissue. Jerking of the head can be further done away with by using the proper type of head rest, and by that is meant the snug-fitting, unpadded concave-disk type that grips the head firmly over and above the mastoid regions.

Oftentimes, an operator is hesitant about making a conductive injection for fear of serious reactions. F. H. Borg, of Chicago, made a careful study of 121

patients undergoing dental treatment in the Cook County Tuberculosis Hospital. These patients formed a segregated group and could be and were closely observed as to reactions to anesthetic solutions commonly used in the practice of dentistry. He says:

> It would seem that the small dosage of procaine-epinephrine as employed in local anesthetic solutions has no consistent relation to the variations observed in pulse rate or blood pressure. If this is true, it could appear to follow that the operator employing local anesthetic solutions as used in the practice of dentistry need not fear that any possible blood pressure or pulse rate changes occurring before, during or after the operation are caused by injection of the anesthetic solutions *per se*. . . . A skillful handling of the patient, minimizing his fear and pain, probably is of more importance in controlling these circulatory reactions than the amount of procaine-epinephrine used.
>
> In the handling of approximately 10,000 sittings in one of the Chicago Board of Health dental dispensaries, the percentage of reactions over a period of six years has been practically nil.
>
> As regards to the "fear of the needle," most of this fear is quickly overcome provided the operations which follow are painless. For instance, if an infiltrative injection has been made to extract a lower deciduous tooth, with the assurance that the extraction will not hurt, but it really does, the child immediately loses confidence in the dentist and in the needle too. His conclusion will be that the injection is apparently a procedure that falls far short of doing what you had promised it would do. Very often, an infiltrative injection is employed in the extraction of lower deciduous teeth, with the idea that if the actual extraction is quickly accomplished, the short duration of the pain will somewhat offset its intensity. Under a conductive anesthetic, the same operation can be accomplished with a deliberate and unhurried decisiveness that begets complete confidence.

Theodor Blum, of New York City, in speaking of local anesthesia says:

> Many attempts have been made to discredit this excellent means of alleviating pain during dental and surgical operations by exaggerating the toxicity of drugs employed and the difficulty of the methods, as well as the dangers from broken needles and the frequency of breakage and the spreading of infection by careless operators. All this is continuously minimized by the steady advance of dental education and the teaching of local anesthesia to students and graduates. At any rate, the objections above mentioned were never important factors against the employment of the method.

One reads a great deal regarding the psychology of handling the child patient. The greatest obstacle that the dentist has to overcome is fear of pain. The only psychology that we employ in overcoming this fear is to assure the child in a positive, confident and kindly manner that he will not be subjected to any pain. Of course, I realize that the dispensary operator who employs conduction anesthesia regularly has an advantage over the operator in private practice who employs the same method, in that the child who comes in for treatment for the first time has usually been assured by the other children in the group that he will not be hurt. He has the advantage of a beneficial group psychology which is denied the lone child who approaches the private practitioner for the first time, perhaps with the stories of his parents' painful experiences ringing in his ears. As a rule, children are very trusting, and, with careful handling, they will usually submit to any procedure which you have promised will be free from pain. At the first sitting when any extensive work is done, a special effort is made to see that it is accomplished without any discomfort. If,

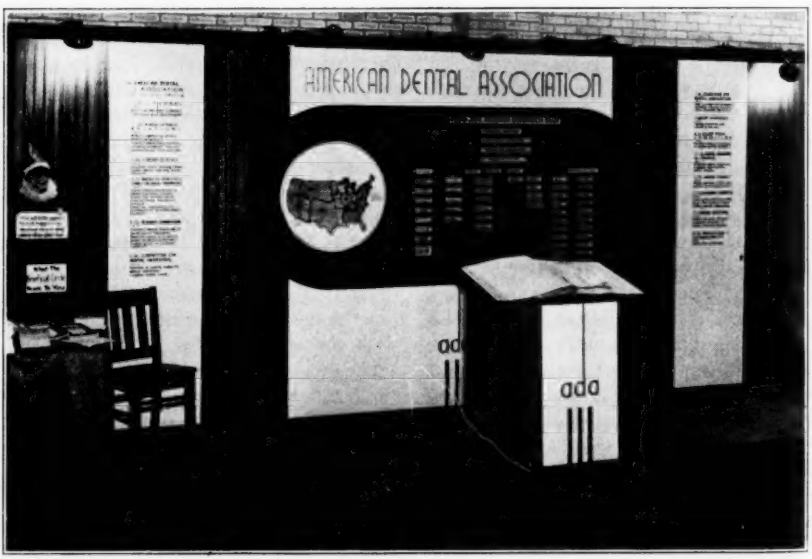
for some reason, that first promise is broken, the remaining task is always doubly hard and sometimes impossible. There is no procedure quite so effective as to promise an absence of pain, and then to keep that promise.

Since the depression, all of us have been forced to develop more efficient methods of operating. There are quite a number of the profession who have, for various reasons, been rather reluctant about doing children's work. It is possible, by adopting conduction anesthesia as a routine procedure, to increase the child clientele as well as the adult practice. By this method, the operating time can be definitely shortened, and more work can be accomplished without taxing the nervous strength of the child. In fact, it is often possible to complete all the work on one side of the mandible at one sitting.

Fillings placed for children under conductive or infiltrative anesthesia will give service for a much longer time by reason of the greater retention obtainable in their preparation. It is not unreasonable to believe that this longer service will help considerably to convince the parents that the conservation of the deciduous teeth is necessary to the good health of their child, and they will not become discouraged in their efforts because the fillings come out every few weeks.

One of the chief aims of the dental profession should be to relieve actual or avoid potential suffering, and every method which can relieve pain and diminish suffering is worthy of careful consideration. Children for whom work has been accomplished under conduction anesthesia will, when they mature, approach the dentist with less fear and apprehension than those who have not had the advantage of this pain-alleviating method.

Let it be said that it is possible, by a broader application of conductive anesthesia technic, to place more and better fillings, with less nervous strain on the child patient and the operator.



A.D.A. exhibit, St. Paul Session, available for display at state and component society meetings.

BUREAU OF PUBLIC RELATIONS

AMERICAN DENTAL ASSOCIATION

212 East Superior Street

Chicago, Illinois

DENTAL HEALTH EDUCATIONAL MATERIAL

Dentists will find some of this material excellent for their waiting room table, and for use at the chair in educating both parents and children. *Education is the basis of preventive dentistry.*

Hygienists, nurses, teachers and public health workers will also find that much of this material will assist them greatly in their health activities. *Education is fundamental in public health work.*

Make use of this dental health educational material—order by number—order blank is printed on page 2071.

Pamphlets on Mouth Health

1. Children's Teeth—How to Use and Keep Them Pt. I (Deciduous Teeth) 3c
2. Children's Teeth—How to Use and Keep Them Pt. II (Permanent Teeth) 3c
3. How to Build Sound Teeth—Children's Teeth Pts. I-II (Prenatal) 3c
4. The Promotion of Health in the Mouth 3c
5. The Masticating Machine 3c
6. What Bacteria Do in the Mouth 3c
7. Outline of Lectures for Nurses ..... No Charge

Talks For Lay Audiences

8. Clean Teeth as an Asset (For high school pupils) 5c
9. The Care of Children's Teeth (For adult audience) 5c
10. A Constructive Program for Dental Health 5c
11. The Teeth and Health (For adult audience) 5c

Radio Talks

12. "Radio Talks" (booklet) contains 22 fifteen-minute talks covering a variety of dental topics; also includes brief instructions to radio speakers 15c
13. 7 minute radio talks (List of 50 different subjects furnished on request) ..... 5c each—6 for 25c

Pamphlets on Nutrition

14. "The Question of Foods," by Ethel Austin Martin, B.C., M.S. 5c
15. "Practical Nutritional Suggestions for Dentists," by Percy R. Howe, D.M.D. 5c

Stories, Plays and Rhymes

16. Better Teeth Better Health Stories 5c
17. Toothsome Stories 5c
18. The Story of the Food Chopper (for primary grades) 5c

19. The King's Soldiers (For primary grades) 5c
20. Stepping Stones to Happiness (dental playlet) 5c
21. Grandfather Molar (dental playlet) 5c
22. Sells Health-O Circus (dental playlet) 5c

(Through the courtesy of the Illinois State Department of Health, the Bureau is enabled to offer the privilege of using the manuscript and staging properties for the very excellent dental health play entitled "Sells Health-O Circus." Information as to the conditions under which circus properties are obtainable may be secured on request.)

Dental Programs

23. "Achievements and Results in West Va. of the Jenkins-Jones Dental Dispensary and McDowell County Dental Clinic," by T. G. Epling, D.D.S. 5c
24. "Public Health Dentistry in Santa Barbara County," by Leo Mollath, D.D.S. 5c
25. "Dentistry in Public Health," by C. T. Messner, D.D.S. 5c
26. "Significance of Clinical Experience as Related to Prevention for the Child Patient," by Lon W. Morrey, D.D.S. 5c
27. "New York Surveys Its Dental Clinics," by the Committee on Community Dental Service, N. Y. Tuberculosis and Health Association 5c
28. "What Is the Economic Value of Dental Health to the Community?" by Arnold M. Kegel, M.D. 5c
29. "Dental Health Week" by C. J. Hollister, D.D.S. 5c

Miscellaneous

30. To Boys 1c
31. To Girls 1c
32. To Mothers 1c
33. The First Permanent Molar 1c
34. "Facts Demanding Serious Professional Consideration as Disclosed by Dental Contact with the Committee on the Cost of Medical Care," by H. L. Phillips, D.D.S. 5c
35. "Proper Dental Care for the Child Patient," by T. A. Gardner, D.D.S. 5c
36. "The Preparation and Delivery of a Speech," by Bertram G. Nelson 5c
37. "Are Extension Courses a Success?" by J. B. Jenkins, D.D.S. 5c
38. "Prosthesis in Children's Dentistry," by F. B. Rhobotham, D.D.S. 5c
39. "Dental Internship in a General Hospital," by D. F. Lynch, D.D.S. 5c
40. "Outlines for Teaching Oral Hygiene from the Kindergarten to the Eighth Grade," by Emma P. Durbin, R.N. 5c

NEWSPAPER ARTICLES

41. "John, Mary & Jack," a series of 52 short semi-continued newspaper stories, approved by the American Dental Association and the U. S. Public Health Service. Prepared for insertion in your local newspaper ..... No charge

Posters

42. *For children,* size 20 by 30 inches, in colors, on high grade cardboard; designed to encourage the child in the care of the teeth $1.00
43. *For adults,* size 20 by 30 inches, in colors, on high grade cardboard; designed to interest parents in the care of children's teeth $1.00

Chart

44. *"A Survey of Dental Diagnosis During Childhood"* 15c

An excellent and comprehensive chart on diagnosis, developed by one of the country's outstanding specialists in children's dentistry. Every dental practitioner needs one. Very useful to a hygienist, nurse, and physician.

A BENEFICIAL PRODUCTION CIRCLE

45. A PRACTICAL TOOTHBRUSHING CHART FOR LAY EDUCATION

The chart shown below (18 by 28 inches) demonstrates a practical toothbrushing method for children and adults. It is printed on heavy paper and securely tinned at top and bottom. For use in schools, dispensaries and private offices..... 50c

1 First thing in the morning and last thing at night, brush teeth. Stand before mirror.

2 Put tooth paste on brush. Brush teeth at least two minutes. Time yourself.

3 Scrub hard two lower and upper bitingsurfaces.Count 20 each surface.

4 Brush outside of all upper teeth from gums down. Right side, left side and front.

5 Brush outside of all lower teeth from gums up. Right side, left side and front.

6 Brush inside of upper back teeth from gums down. Right and left.

7 Brush inside of lower back teeth from gums up. Right and left.

8 Brush the upper front teeth on inside from gums down.

9 Brush the lower front teeth on inside from gums up.

10 Well cared for teeth; a pleasant smile and face for life.

46. MOTION PICTURE FILM SERVICE

Dental educational films are available in both 35 m.m. and 16 m.m. stock. These may be rented for $1.00 a day or $3.00 a week, plus shipping charges both ways. Charge is made for each day of use before an audience, but no charge for time in transit. The renter is held responsible for injury to films. *In requesting films, please state the ones desired, when desired and for how long.* Following is a description of the films available:

"Your Mouth" (35 m.m.), 15 minutes. Synopsis: Gives cause, progress and results of tooth decay; methods of prevention; brings in nutritional aspect, use of roentgen rays, brushing, etc. Suitable for high school and adult audience.

"Tommy Tucker's Tooth" (35 m.m. and 16 m.m.), 15 minutes. Synopsis: The "Tell-a-Story-Lady" narrates to a group of children the importance of keeping teeth in good condition. Animated scenes used effectively.

"Clara Cleans Her Teeth" (35 m.m. and 16 m.m.), 15 minutes. Synopsis: Clara, aged 10, always neglected her teeth until she learned, through her playmates, the importance of daily brushing and care. Interesting story which impresses lesson effectively.

"Tommy's Troubles" (35 m.m.), 20 minutes. Synopsis: On oral hygiene. Emphasizes importance of diet as well as cleanliness in care of teeth; shows proper method of brushing them.

"Bobby's Bad Molar" (35 m.m. and 16 m.m.), 15 minutes. Synopsis: Bobby has neglected his teeth and is paying the penalty by doing poor work in school, being backward in athletics, etc. One day his teacher sends him to the school dental hygienist, who examines his teeth. The hygienist explains Bobby's teeth troubles to him and urges him to go to the dentist at once and receive attention. Bobby takes her advice and finally becomes an enthusiastic advocate of the proper care of teeth.

"Life of a Healthy Child" (16 m.m.), 15 minutes. Synopsis: Illustrates healthful activities of a normal school child. Habits of cleanliness, correct diet, carefree play, visits to dentist and physician are emphasized. Excellent for parent-teacher groups or child audiences.

"Ask Your Dentist" (35 m.m. and 16 m.m.). Excellent for high school and adult groups. Stresses the importance of diet, cleanliness and dental attention. A touch of humor is added by the use of cartoons.

"How Teeth Grow" (16 m.m.), 15 minutes. Synopsis: Eastman classroom film for health education. Shows in interesting and instructive manner growth and development of temporary and permanent teeth. Demonstrated through use of animation, models, and subjects of various ages. (For children and adults.)

"Care of the Teeth" (16 m.m.), 15 minutes. Synopsis: Eastman classroom film for health education. Shows various phases of care of teeth such as diet, care by dentist, brushing and home care. Useful in giving fresh support to activities of dental hygiene program. Designed for individuals above fourth grade.

Technical Film: "The Physiology of Mastication" (16 m.m.); 2 reels. Synopsis: Study of jaw movements of various animals exhibiting types of mastication as an introduction to study of human beings. Animated skulls and cartoons are synchronized with mandibular movements of animals. The film shows that "three point contact" and "bilateral balanced occlusion" never occurs in lower animals during process of incising and chewing tough resistant food.

Technical Film: "Mechanics of Balance in Dental Prosthesis" (16 m.m.); 1 reel. Synopsis: Depicts clinical application of unilateral balance to prosthetic dentistry. Film is a continuation of the above-mentioned film, "The Physiology of Mastication."

Technical Film: "Uses of Gelatin in Dental Arts" (16 m.m.); 2 reels.

"Nature—Builder of Teeth" (16 m.m.); 1 reel shows the development of teeth from birth to adulthood. Explains the part played in facial development by the erupting forces of teeth; also effect of nutritional disturbances and illness on tooth development; mottled teeth, normal and abnormal occlusion, are portrayed. Written lecture accompanies film. Can be purchased for $25.00, or rented for usual rental fee.

47. LANTERN SLIDE AND MOTION PICTURE FILM SERVICE

Lantern Slide Lectures:

1. "The Tooth Question," lecture (for adult audiences); 42 slides. (Requires one hour to present.)

2. "The Mouth and Its Message," lecture (for adult audiences); 13 slides. (Requires thirty minutes to present.)

3. "Every Child's Treasure," lecture (for school children of first six grades); 31 slides. (Requires thirty minutes to present.)

4. "The D. Kay Brownies," lecture (for school children of first four grades); 10 slides. (Requires twenty minutes to present.)

Note: Copies of the foregoing lectures are furnished free, although a small rental fee is charged for the slides (see lantern slide service).

5. "Johnny Don't Care's Teeth" (for fourth to eighth grade children); 22 colored slides. Self-explanatory; no written lecture necessary.

Lantern Slide Rental Service:

The Bureau has a large collection of slides (standard size, 3¼ by 4 inches) suitable for professional and lay groups. A complete list of these slides will be furnished on request. Any selection of slides may be rented on the basis of $1.00 a day or $3.00 a week, plus shipping charges both ways. No charge is made for time in transit or time spent in review. In requesting slides (provided you do not order from our list), please state the topics that you desire to cover, type of audience, number of slides, when wanted and length of time desired. The renter is held responsible for all breakage.

Lantern Slide Sales Service:

The Bureau will sell duplicates of any stock slides at the following prices: plain slides, 35c each; colored slides, 75c each. On request, the Bureau will prepare slides from photographs or cuts on the following basis: *plain slides:* negative, 25c; slide, 35c; making total cost for each original slide 60c; *colored slides:* negative, 25c; slide, 75c; making total cost for each original slide $1.00. *Remittance must accompany all orders.*

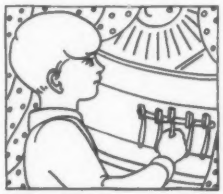
A BENEFICIAL PRODUCTION CIRCLE

48. FIRST GRADE DENTAL EDUCATIONAL LEAFLETS

GO TO THE DENTIST AT LEAST TWICE A YEAR

The dentist is my friend.
He helps me to have nice teeth.
I go to see him often.
Sometimes teeth have little holes in them.
If there are little holes in my teeth
the dentist will fill them.
He will help me to keep my teeth clean.

BRUSH YOUR TEETH TWICE A DAY



Here are our tooth brushes.
They are hanging in the sun.
The brushes are all small.
They have pretty colored handles.
The one with the yellow handle belongs to my mother.
The one with the green handle belongs to my father.
The one with the blue handle belongs to my sister.
The one with the red handle belongs to me.
I brush my teeth every night.
I brush my teeth very morning.

TOOTH BUILDING FOODS

Milk helps to build strong teeth.
Dark bread helps to build strong teeth.
Dark cooked cereals are good foods to build teeth.
I eat cereal and milk for my breakfast.
I sometimes have toast for my breakfast.
My teeth need milk and cereals.

This new series of six leaflets designed for first grade dental education is now ready for distribution. Each lesson is printed on 8 by 11 inch drawing paper. The wording is fitted to first grade vocabulary. The text is scientifically correct. The drawings are simple and artistic. After each lesson is learned, the drawings are to be colored by the child. This material will enable educators to coordinate the teaching of dental health with that of art and reading.

One set of six leaflets, 5 cents. Twenty-five sets of leaflets, 50 cents.

TOOTH BUILDING FOODS

I will color the cabbage green.
I will color the oranges.
I will make the apples red.
I will color the spinach green.
I will color the tomatoes red.
Fruits and vegetables help to build strong teeth.

CHEW FOOD WELL

I run and play to make my muscles strong.
Exercise makes strong muscles.
I chew crisp foods to make my teeth strong.
Exercise makes strong teeth.
Crisp toast and crusts are good foods
to exercise teeth.
Celery and apples are crisp foods to exercise teeth.
My teeth need exercise.

NO CANDY BETWEEN MEALS

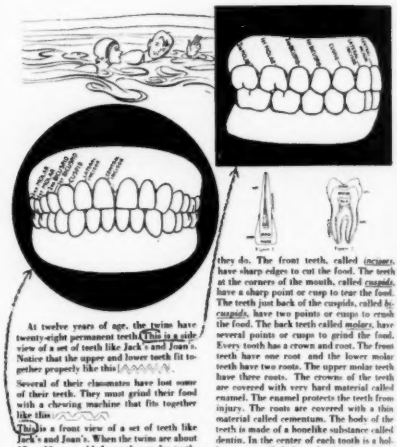
Candy and sweet foods do not build teeth.
I eat candy or cake or pudding after my meal.
First I eat the foods that build my teeth.
Then I eat sweet foods.
I sometimes eat candy and sweet foods
after I have eaten foods that build my teeth.
Candy does not help to build teeth.

49. FOURTH GRADE DENTAL EDUCATIONAL BOOKLET

Jack and Joan are twins. They were twelve years old their last birthday. They have never had a single day of sickness. People who know them say they are the peppiest and liveliest children in town. They are never idle a minute. In the summer, they love to swim, ride and play tennis. In the winter, they enjoy skating, coasting and skiing. They are as happy and healthy as twelve year old children can possibly be. Both the winter and summer months are crowded with happy days for Jack and Joan. There are several reasons for these happy days which they learned from Uncle Dan. One of these reasons is told and pictured on the inside pages of this book. Color the pictures with crayon or water colors as you read the story of Happy Days.

Approved by
THE AMERICAN DENTAL ASSOCIATION and the UNITED STATES PUBLIC HEALTH SERVICE

Distributed by
THE BUREAU OF PUBLIC RELATIONS, AMERICAN DENTAL ASSOCIATION
211 E. Superior St., Chicago, Ill.

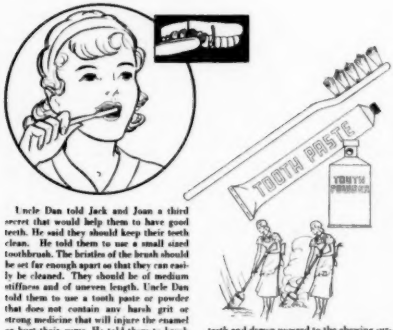


At twelve years of age, the twins have twenty-eight permanent teeth. This is a side view of a set of teeth like Jack's and Joan's. Notice that the upper and lower teeth fit together properly like this

Several of their classmates have lost some of their teeth. They must grind their food with a chewing machine that fits together like this

This is a front view of a set of teeth like Jack's and Joan's. When the twins are about 18 or 20 years old, four other molar teeth, commonly called "wisdom teeth," will appear. Jack and Joan then will have their full set of thirty-two permanent teeth.

Notice the shapes of the teeth. The teeth are shaped differently because of the work they do. The front teeth, called incisors, have sharp edges to cut the food. The teeth at the corners of the mouth, called cuspids, have a sharp point or cusp to tear the food. The teeth just back of the cuspids, called bicuspids, have two points or cusps to crush the food. The back teeth called molars, have several points or cusps to grind the food. Every tooth has a crown and root. The front teeth have one root and the lower molar teeth have two roots. The upper molar teeth have three roots. The crowns of the teeth are covered with very hard material called enamel. The enamel protects the teeth from injury. The roots are covered with a thin material called cementum. The body of the teeth is made of a bonelike substance called dentin. In the center of each tooth is a hollow space called the pulp chamber, which contains the pulp. The pulp is made up largely of blood vessels and nerves. Figure 1 shows the different parts of a front or incisor tooth. Figure 2 shows the different parts of a lower molar tooth.



Uncle Dan told Jack and Joan a third secret that would help them to have good teeth. He said they should keep their teeth clean. He told them to use a small sized toothbrush. The bristles of the brush should be set far enough apart so that they can easily be cleaned. They should be of medium stiffness and of uneven length. Uncle Dan told them to use a tooth paste or powder that does not contain any harsh grit or strong medicine that will injure the enamel or hurt their gums. He told them to brush their teeth at least twice a day, after breakfast in the morning, and before going to bed at night.

This is the way Uncle Dan taught Jack and Joan to clean their teeth: Hold the jaws slightly apart. Brush the teeth of each jaw separately. Place the bristles of the brush on the gums above the upper teeth and brush down from the gums to the chewing surface. This downward movement brushes the food from between the teeth. It also massages the gums. Never brush across the teeth, because this will not remove the food from the crevices and moreover, may injure the gums. The lower teeth should be cleaned in the same way as the upper teeth. The brush should be placed on the gums below the teeth and drawn upward to the chewing surface. Brush the inside surfaces of the teeth as well as the outside surfaces. Do not fail to brush the chewing surfaces of the teeth as these uneven surfaces easily catch and hold particles of food.

If the twins' mother swept in circles, she would not get much dirt off the kitchen floor. By sweeping with long, even strokes, she removes the dirt easily. So it is with brushing the teeth. We should brush the upper teeth with a downward sweeping motion, and the lower teeth with an upward sweeping motion. This will remove any small food particles that might lie between the teeth. After thoroughly brushing the teeth, the mouth should be rinsed by forcing a mouthful of water several times between the teeth.

DENTAL HEALTH EDUCATIONAL MATERIAL FOR FOURTH AND FIFTH GRADE CHILDREN

Happy Days with Jack and Joan is an eight page booklet on the care of the teeth which has been especially designed for children between the ages of nine and eleven.

The names, structure and function of the teeth, as well as the fundamentals of dental health, are explained in an interesting, yet simple manner. The text is scientifically correct. The illustrations are modern and artistic. After each lesson is learned, the illustrations can be colored by the child. This booklet will enable educators to coordinate the teaching of dental health with that of art and reading.

Approved by educators, the American Dental Association and the United States Public Health Service.

Single booklet, 10c; sets of 25 booklets, 5c each; 50 copies or more, 4c each; including postage.

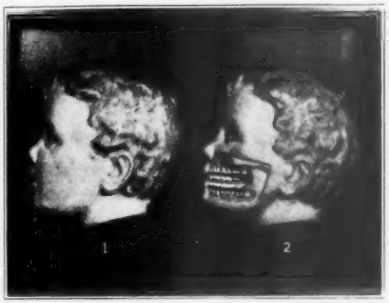
50. DENTAL EDUCATIONAL MODELS

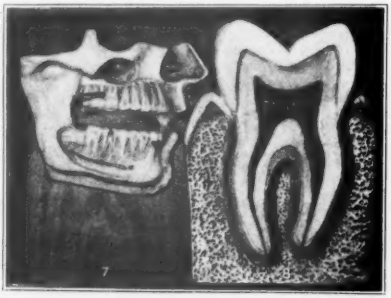
SIXTEEN LARGE COLORED WAX MODELS SHOWING NORMAL AND ABNORMAL DENTAL CONDITIONS, MOUNTED IN NEAT BLACK SHOW CASES READY FOR USE. EXCELLENT FOR DEMONSTRATION PURPOSES.

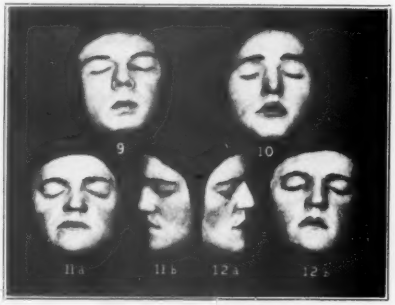
A BENEFICIAL PRODUCTION CIRCLE

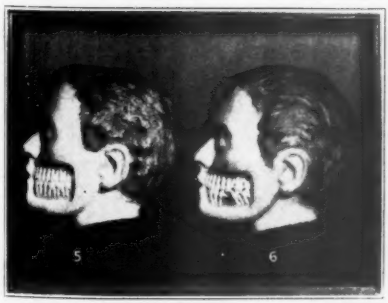
Models 1 and 2 show dentition of 6 year old child; 3 and 4, thumb sucking; 5 and 6, normal occlusion and results following loss of first permanent molar; 7 and 8, cross section of mouth and longitudinal section of molar; 9 to 12, facial deformities resulting from loss of first permanent molar; 13 and 14, destructive action of calculus and decay.

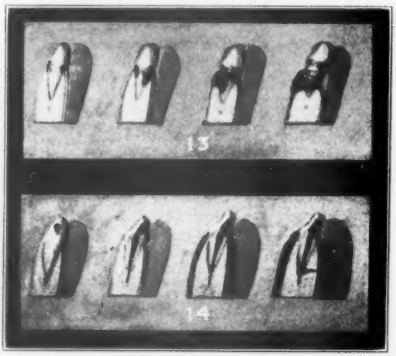
Models 1 to 6, inclusive, rent for $2.00; 7 to 12 inclusive, $2.00; 13 and 14, $2.00; entire set rents for $5.00—plus express charges to and from Chicago.











51. BOOKLET ON CARE OF THE TEETH

Attractive 32 Page Booklet

Approved by

THE AMERICAN DENTAL ASSOCIATION

and by

THE UNITED STATES PUBLIC HEALTH SERVICE

1	Booklet	10c
12	Booklets	$ 1.00
50	Booklets	$ 4.00
100	Booklets	$ 7.50
500	Booklets	$25.00
1000	Booklets	$45.00

In its preparation, infinite care has been used to couch all information in lay language without distorting the scientific content. **It is illustrated with eighty beautifully clear photographs of actual cases and models.** Their accompanying captions, legends and overprint enable each illustration to tell its own story. It is just the kind of book on this subject that you have been waiting for, the type of book that every mother, nurse, hygienist, teacher and health worker will want for their own use when they see it in your office.

THE BENEFICIAL CIRCLE PLAN
and the
DENTAL EDUCATIONAL MATERIAL

Much of the dental health educational material listed in this prospectus has been developed under the "Beneficial Circle" Plan. Other material is being developed and will be released as rapidly as the facilities and support of the plan permit.

All of the dental educational material offered by the Bureau of Public Relations is ethical, authentic and interesting. Most of the newer material will be offered to the public under the approval of the United States Public Health Service as well as the American Dental Association.

ASSIST THE BENEFICIAL CIRCLE PLAN BY USING and recommending products advertised in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION as increased advertising revenue will be used to develop further educational material.

LOOK FOR THE SIGN

ORDER BY NUMBER

The Bureau of Public Relations,
American Dental Association,
212 E. Superior St., Chicago, Illinois.

Enclosed is $_____ for Dental Health Educational Material corresponding to numbers below:

_____

_____

Name _____

Address _____

Special Notice: To assist the Bureau in eliminating unnecessary bookkeeping and correspondence, *please remit the amount of your order at the time of ordering.* Remit by post-office money order or stamps. *Please do not send personal checks for amounts of less than one dollar.*

CURRENT LITERATURE

Gargling and Throat Irrigation (W. Snow and J. E. Stern, J.A.M.A., Sept. 15, 1934): For observation, a thin liquid suspension of barium sulphate was used in conjunction with lateral roentgenograms of head and neck. The method included violent gargling, gentle gargling and gargling with the head tilted to allow the suspension to run back as far as possible into the throat. In such instances, the tongue kept the fluid from passing the anterior faucial pillars. This type of gargling is ineffective. Gravity irrigation should be used to obtain the desired results.

Studies in Agranulocytosis Following Use of Dinitrophenol (W. Dameshek & S. Gargill, New England J. Med., Sept. 6, 1934): The authors make reports of two patients who developed agranulocytosis while taking dinitrophenol in therapeutic dosage for obesity. Complete detailed case histories are given. One patient died, the agranulocytic condition not being recognized until the day before death. Diagnosis was made in the second case on the appearance of gingivitis. Despite the absence of definite proof, the conclusion as to cause is regarded as logical. The concept that this disease is precipitated by drugs containing the benzene ring in association with the NH_2 or NO_2 grouping appears to be supported by these cases.

Nature and Uses of Beechwood Creosote (Lucius F. Herz, Clin. Med. & Surg., September, 1934): Creosote and its derivative and chief constituent guaiacol were first given publicity for therapeutic use in 1887. Topically, it is a powerful antiseptic, an astringent and a local anesthetic. Diluted in liquid petrolatum, glycerine or water, it may be used to swab the nose and throat, or as gargle or spray. It is stimulating and mildly hemostatic. It is useful in coryza, laryngitis, tonsillitis, bronchitis and ozena. Solis Cohen recommends it for inhalations. He recommends it as indispensable in pulmonary tuberculosis. It is used full strength to stop toothache and in the preparation of cavities.

Business Approach to the Patient (C. C. Patchen, Clin. Med. & Surg., September, 1934): The author says disregard of business methods is the main reason that many physicians' savings are inadequate to support them in late life. He urges the establishment of a sound credit basis as is done in business, employing personal questions, a third party, the local chamber of commerce credit bureaus and the like. He insists that the practice of medicine and surgery is a business.

Clinical Circulatory Effects of Dinitrophenol (A. B. Stockton and W. C. Cutting, J.A.M.A., Sept. 22, 1934): The occasional appearance of subjective symptoms in obese patients such as tachycardia, dyspnea and diffuse diaphoresis led to an investigation of the effect of the drug on the circulation. Thirteen patients were selected for the study. Six were placed in bed. The rest remained ambulatory. Vital capacity and systolic and diastolic blood pressure were not significantly affected by the sodium dinitrophenol. The oral administration to resting patients of the drug in therapeutic doses during short periods of time caused no significant changes in vital capacity and in blood pressure. There were significant increases in pulse rate and in venous pressure.

Research Versus Practice: There are those who think that success as a practitioner will come only if much time is devoted in undergraduate and later years to research. There is a strange fascination about research. As Zinsser has said, "There has developed a curious halo about research which has exalted it above other and, in the absence of talent, more useful and less expensive methods of occupying

time." There should be no quarrel with research *per se*. There is no higher type of work. It is the activating, catalyzing agent in the science of medicine. Without laboratory experimental research, medical science will stagnate and the art of medicine will revert to its old status of empiricism. Yet many research men or, should I say, many men who are working in research laboratories or wards, become poor practitioners. Is this in spite of research or because of it? Some of these men when they start to practice are unable to get down to the level of the everyday problems of the sickroom. They are visionary, with the eyes accommodated for distance; they fail to recognize a clinical fact when they meet it face to face or even when they stumble over it. They detour around the fact, get off the track. And the pathos of it all is that they don't know they have lost their way. Some of them have a mania for experimentation, they toy with tentative diagnoses, they try new remedial agents that are *a priori* unsuitable or even dangerous. They are not only inefficient as practical physicians, they are at times a menace to the patient, who after all should not be regarded solely as an experimental animal. Surely research is not the *sine qua non* in the making of a clinician. The spirit and the methods of research? The ability to reason logically? The necessity for control? Emphatically yes. Compulsory research for all? No!—J. B. Herrick in "The Practitioner of the Future," *J.A.M.A.*, Sept. 22, 1934.

New Worlds to Conquer: We must continue and increase our study of disease and maintain such holds as we have on it, but at the same time we must pay more attention to the acquisition and the maintenance of positive health—to the small important factors of body mechanics and hygiene and nutrition, of rest and exercise, of fatigue and endurance both physical and mental. The battle against pneumonia must be waged relentlessly, but of equal importance, so far as the economy and the joy of living are concerned, is the common cold, uncomplicated. Tuberculosis of the spine is of less importance to millions than are flat feet. The diseases due to gross vitamin deficiencies are well known; we must consider with even greater seriousness, as they are brought to our attention, the possibilities of minor deviations from health from the same causes, which, though less obvious, may affect millions. Dental caries, in the aggregate, is a more important departure from the normal than is scurvy. The public is clamoring to know the way to better health. The answer must not be left to the bakers, the mattress makers, the California fruit growers or the manufacturers of any brand of tooth paste. —Editorial, *New England J. Med.*, Sept. 27, 1934.

Individualism in Practice: I wish to speak of the value of individualism as it applies to the practicing physician, using the term not in a technical sense as referring to a school of philosophy opposed to collectivism but to indicate that which makes one man differ from another, his inherent peculiarity, his individuality, with also an element of independence. There is today much over-standardization in education as well as in business, politics, social customs. From our schools, there is turned out as product a mass of units almost uniformly alike, with the individual ruggedness and earmarks of personal identification worn off. One might think that when a physician escapes from the rigid curriculum of his professional school and enters on his vocation he would be himself. Yet often this is not true. He slips into his place in society and acts as though his job were to keep in line following the rules of the well beaten road, not even stopping to read the signs at the crossroads—simply following as one of the hurrying crowd. Such a course means repression of individuality, the dwarfing of self, the stifling of independent thinking, the loss of initiative and opportunity for constructive leadership, and of that which goes to make life "individual, elastic, thrilling."—James B. Herrick in "The Practitioner of the Future," *J.A.M.A.*, Sept. 22, 1934.

Heredity in Harelip: A young couple, both university graduates, have recently consulted me in regard to the possibility of

having another child. One year ago they had a baby born with a harelip, although the pregnancy was apparently normal. The question asked me was "In the event of another child, what are the possibilities of a recurrence of harelip or some other anomaly?" The mother has recently been examined by a physician, who suggested a possibility of hypothyroidism; a basal metabolism test has been arranged for. Is there anything that can be done to assist in the prevention of such an anomaly? Is harelip a recessive or a dominant trait? In view of the chances of a recurrence, is it best to advise those parents to have no more children? M. D., California. *Answer:* The available statistics would suggest that there is a hereditary predisposition in something like 30 per cent of the occurring cases of congenital facial clefts. However, if there are no other cases in the family there is probably no more reason to expect other children to be so afflicted than in a family with a negative history of such a deformity. There does not seem to be anything that can be done to assist in the prevention of such an anomaly, although there is a suggestion that some of these cases are associated with extreme vomiting early in pregnancy. In some others the mother gives a history of having had a serious tooth complication early in pregnancy, but the relationship of this to the occurrence of harelip is not conclusive. Harelip is a negative and not a positive condition, and there probably are as many causes for it as there might be for a fracture of a leg. There is no apparent reason why the parents should be advised not to have other children. If properly cared for, these children are about as well off as the average.—Queries and Minor Notes, *J.A.M.A.*, Sept. 15, 1934.

Palpitation and Nervousness After Procaine and Epinephrine: It has come to my attention that occasionally, after the injection of a local anesthetic solution such as procaine combined with epinephrine, the patient complains of palpitation and nervousness. Kindly outline the anatomic course of the impulse generated by the vasoconstriction at the site of the injection (for example, an injection surrounding the tonsil) to the structures involved in producing the subjective symptoms of palpitation. Do you know of any method of preventing these symptoms from developing in sensitive patients? H. C. Scholar, M.D., Detroit. *Answer:* These are not uncommon symptoms following such injections. Unfortunately, a general satisfactory explanation cannot be offered. The palpitation of nervousness following injections of procaine solution containing epinephrine is not due to reflex generated at the site of vasoconstriction but probably to the following factors: 1. Anxiety and fear of operation in highly nervous individuals, which will induce palpitation and this, in turn, more nervousness. 2. A too rapid entrance into the circulation of some of the epinephrine and procaine from the site of injection. 3. The possibility that at the time of injection the point of the needle may empty directly into a small vein and hence a fairly large quantity of the substance enter the general circulation rather rapidly. 4. Hypersusceptibility of some individuals to both epinephrine and procaine and its allies. Patients with hyperthyroidism, many women at the menopause, persons with hypertension, and those with neurocirculatory asthenia are said to be highly susceptible to epinephrine. All the commonly used local anesthetics have caused such untoward symptoms, which have been attributed to idiosyncrasy or hypersusceptibility. There is a possibility that these symptoms may be prevented by the preliminary administration of a sedative such as barbital, about 0.3 gm. (5 grains) by mouth, half an hour before the local injection is made. Secondly, all injections should be made rather slowly, precautions being taken to avoid the possibility of direct entrance of the needle into a vein. With slow injection the operator may better detect an idiosyncrasy to the drugs.—Queries and Minor Notes, *J.A.M.A.*, Sept. 15, 1934.

Another Diagnostic Sign in Syphilis (J. B. Biederman, Am. J. Syph. & Neurol., July, 1934): Biederman discusses a diagnostic aid which is concerned with a change in the appearance of the anterior pillars of the throat. The anterior pillars in the nor-

mal throat have a certain healthy pinkish color merging imperceptibly with the pink of the surrounding healthy mucous membrane. During the recent examinations of the throats of a large number of patients having so-called latent syphilis, it was observed that frequently there was an associated change in the appearance of the anterior pillars. This change was apparently due to an alteration in color in which the pillars assume a dark, dusky red shade, in a well defined congested area. This area began at the base of the pillars and extended upward from 0.5 to 2.5 cm. and was approximately from 6 to 10 mm. in breadth. The appearance was that of a definite vascular congestion. In the examination of 469 syphilitic patients, this sign was present in 69.1 per cent. Not every case of syphilis presented this sign, nor could every patient having this sign be proved to be syphilitic. This sign should not be confused with the secondary erythema of syphilis, which may be localized only on the anterior pillars or be present on any other portion of the mucous membrane.—Abstr. *J.A.M.A.*, Sept. 15, 1934.

Vitamins A and D and Dental Caries (C. D. Marshall Day and H. J. Sedwick, J. Nutrition, Sept. 10, 1934): Concentrates of the vitamins were given in tablet form, the daily ration being not less for each child than 6,000 U.S.P. units of vitamin A and 1470 Steenbock units of vitamin D in the form of viosterol. The experimental group numbered 147 children of 13 years of age and of both sexes, that age being chosen because of the evidence of caries at that period. Another group of 171 controls receiving no vitamin concentrates were kept under observation. The vitamins were superimposed upon the ordinary diet of the children, the question prevailing whether the use of the vitamin arrested active caries or retarded caries. The experiment ran from October, 1932, to December, 1933. The result was entirely negative.

Foreign Literature

Condition of the Gums During First Dentition (A. G. Alarcon, Nourrisson, July, 1933): Preceding the eruption of the first teeth, babies commonly bite on any objects that some into their hands. Alarcon believes that this is done, not on account of pain or discomfort in the gums, but simply as a manifestation of the early development of the muscles of mastication aggravated by the generalized muscular hypertonicity characteristic of young babies. —Abstr. *Am. J. Dis. Child.*, September, 1934.

Researches on Elective Localization of Streptococcic Strains Inoculated by Dental Route (B. Mela, Stomatologia, July, 1934): Continuing his study of focal infection, the author has attempted to reproduce it in dogs by infecting the root canals of some teeth with streptococcic strains isolated from oral foci of patients suffering with chronic articular rheumatism and nephritis. In two out of the five inoculated dogs which had previously shown no morbid phenomena, the strains originating, respectively, from patients with arthritis and from those with nephritis, caused corresponding arthritic and nephritic lesions. The author explains the mechanism of this phenomenon on the basis of an allergic reaction of the tissues.

Contribution to the Study of Primary Lupus of the Gums (Jacques Merle-Beral, Semaine Dent., Sept. 9, 1934): Lupus is known to be a tuberculous disease. The presence of tubercle bacilli in the oral lesions makes the diagnosis a certainty. It is rare to find them in the follicles. In the past, gingival localization of lupus was believed to be unusual. It is thought to be less rare now than was formerly believed. It occurs chiefly in women between the ages of 20 and 30. It appears with the greatest frequency in people who already have tuberculosis. Irritation plays a definite part in "fixing" the lesions in the gums. The clinical characteristics of the disease are easily recognizable. The prognosis of the disease is serious when it attacks the "neck" of the teeth. They loosen and fall out and osseous sequestration frequently occurs. The coexistence of pulmonary tuberculosis also makes the prognosis grave. There are many possible treatments. Surgery is good when possible, but the author's choice is

ignipuncture and linear scarification with weak roentgenotherapy.

Bactericidal Power of Human Mixed Saliva. Study on Means of Organism's Natural Defenses (Omero Tempestini, Stomatologia, July, 1934): The author, with three different series of experiments, shows that the saliva develops a bactericidal action, thus contributing to the natural defense mechanism of the organism. Fresh saliva removed under hygienic conditions is more bactericidal than filtered saliva. The hydrogen-ion concentration of the saliva must be different from that required by the bacteria for growth and development in its culture medium. The chemicophysical reaction of the saliva contributes in an evident manner to the so-called bactericidal power of the salivary secretion.

Normal Sensory and Histologic Findings on Innervation of Human Dentin (J. Münch, Deutsche Zahn-Mund' u. Kieferheilk., August, 1934): Münch reports researches carried out in 1931 with Schriever. The sensory reception of teeth was shown to be much poorer than that of the mucous membrane or the skin. He reduces the possibilities in teeth to the sensation of pain only. This he contrasts with the observation of Stein, Walkoff and Spring, who added pressure, cold and warmth. He agrees with Weber, Frey and Türkheim. He notes the variation of sensory receptivity on the different surfaces of the teeth, which he assumes to be dependent on the thickness of the enamel. Rautmann, a student of Münch's, supported this observation. For demonstrating the medullated nerves of the pulp, he used the osmiumtannin method; for the terminals in the dentin, the silver impregnation method. He summarizes his findings as follows: The nerve fibers in dentin spring as a rule from the plexus of Raschkow. The fibers course in the dentinal canals and also in the ground substance. The canal fibers give off numerous long and short fibers which run into the ground substance.

Contributions to Histochemistry in the Development of the Teeth (E. Hintzsche, M. Baumann and, Z. Mikrosk, Anat. Forschr., 1933, pp. 333-352): The successfully completed observations of the occurrences in osteogenesis and in the healing of fractures were the initiative for this study, its relation to the formation of the hard structures in teeth. In connection with this study, the authors explain how the reactions of calcium, phosphorus and potassium take place during tooth formation. They point out the various differences among the hard substances of the tooth, also the deviations in the study of fresh and old materials. They cannot give an explanation of the question of the hardening of enamel. They prove histochemically that the odontoblastic layer serves as a medium of transportation of inorganic substances in the tooth.

Innervation of Human Dentin (Minoru Toyoda, Tokio, Tr. Nippon D. Ass'n, 1933; Ztschr. f. Stomatol., June 8, 1934): Toyoda has occupied himself with this question since 1921. According to his investigations, the human dentin is innervated by nonmedullated nerve fibers. The latter come from the nerve bundles of the pulp and penetrate through the odontoblastic row into the dentin. The fibers are close to the odontoblastic processes and wind about them up to the periphery of the tubuli. According to Toyoda, these intratubular nerve fibers run in the lymph slit between Tomes fiber and the wall of the tubule. From the main stem of the nerve fiber, there bud forth branches which spin around the dentinal fiber. The lateral branches run in the dentin ground substance and form a wide-meshed net in the matrix. Through certain treatment of the preparation, it was possible to trace even nerve fibers which ran through the dentinoenamel junction and terminated in the enamel. Often, the nerve fibers end in a small end apparatus, which can show various forms. The technic employed is important: Fixation was in 10 per cent formalin. The tooth was divided into small pieces. Toyoda used 10 per cent *Ameisensaure* solution. The completion of decalcification was established chemically. The acid was neutralized with *Lithiumkarbonat.* Important is the washing of the object, which was electro-osmotic. The

apparatus and technic are described in detail. After washing, a silver or gold impregnation follows. Toyoda recommends gold block impregnation. He shows numerous illustrations as evidence for his findings.

Agranulocytosis Due to Medicaments (J. Groen and C. J. Gelderman, Nederland. Tijdschr. v. Geneesk., July 28, 1934): Groen and Gelderman sought to determine what drugs were used by patients who were treated for agranulocytosis. Of thirteen cases observed during the last three years, neo-arsphenamine was a causative factor in two. Nine patients had been taking some drug containing antipyrine or amidopyrine, often in combination with some other compound, before the onset of their symptoms. In one case recovery of the number of leukocytes and of the necrotic angina was observed after discontinuance of amidopyrine medication. In two cases an inquiry among the physicians who had been treating the patients before their admission revealed only the use of acetylsalicylic acid, sodium salicylate and quinine sulphate; but the possibility that other drugs had been taken could not be excluded. Five additional cases, observed elsewhere, are described. In each case, some compound containing amidopyrine had been used. The authors maintain that an outbreak of agranulocytosis may follow the use of various drugs. Among those antipyrine and amidopyrine have a definite etiologic significance. The possibility of a similar effect of other antipyretics and hypnotics (especially the two barbiturates) must be borne in mind. The danger of an agranulocytotic syndrome occurring after the use of drugs is probably restricted to certain allergic individuals. Many present conceptions about agranulocytosis must be revised; a toxic etiology of agranulocytosis appears to be the rule rather than the exception. During the administration of antipyrine or amidopyrine, a continuous supervision of the leukocyte count is imperative.—Abstr. *J.A.M.A.*, Sept. 8, 1934.

Orthodontia Appliance from Inoxydizable Steel (A. Tsukanelis, Greek D. Rev., June, 1934): With the discovery of the nonoxydizing steel, orthodontia has gained a very valuable metal that may eventually replace gold and its alloys as appliances. The springiness of this material, its strength, which is about four times that of the gold alloys, and consequently the fineness of the wires, its failure to oxydize in the fluids of the mouth, the greater tolerance by the soft tissues, its esthetic and antiseptic qualities and its inexpensiveness render it the most important material for straightening teeth. This material can be soldered and manipulated as easily as gold alloys and done practically with the same equipment.

Hyperemia of the Pulp as a Result of High Arterial Pressure (R. P. Petropulos, Greek D. Rev., August, 1934): Among the intrinsic causes of hyperemia of the pulp, e.g., abnormal systemic disorders such as syphilis fever, high arterial blood pressure is included by Dr. Petropulos, of Serrai. A woman, aged 58, came in with a terrific pain in her teeth. Her teeth seemed to be perfect except that they were of greenish hue. She had three children, two of whom were alive and healthy. She had no disease. In her younger days, she had irregular monthly periods and sometimes she was ill with nephritis. She was slightly overweight. There was no inflammation in her mouth. On opening into the pulps, not only did the pain disappear, but there was an influx of blood. The cavities were sealed temporarily. Within twenty-four hours, the pain returned with greater intensity. On opening again, relief came. The patient was referred for general physical examination. Her arterial pressure was 23. When the cavities were closed with a pellet of cotton and formalin, there was no pain. When the pressure was reduced, the cavities were sealed.

NEWS

CALIFORNIA

Bulletin of the Alameda County Dental Society to Be Published Monthly: In the past the *Bulletin* has been a semiscientific publication, many of the articles being reprints which had been published previously in other dental periodicals. The board of directors felt that to serve the greatest need, it should be published monthly. All problems being considered, it was decided to lessen the number of plates and eliminate the scientific articles. Hereafter, the *Bulletin* will be published monthly. It will serve as the program of the meeting and will carry brief descriptions of the clinics and qualifications of clinicians. Items of general and vital interest to the dentists of Alameda County will be printed.

School Dental Plan: At a special meeting held June 7, the Alameda County Dental Society accepted the following plan: 1. The Alameda County Dental Society agrees to take care of those school children of the Alameda County Schools who are unable to pay the regular fees charged by reputable dentists of Alameda County, and to restore their mouths to proper health at a fee which is in accord with their ability to pay, excepting indigents. 2. In return for this service, the board of education agrees to maintain such dental health education for school children as the Alameda County Dental Society considers adequate.

1935 Pacific Coast Dental Conference: With the national and state association meetings now a matter of record, efforts are being directed toward preparation for the 1935 Pacific Coast Dental Conference, to be held in Long Beach, July 8-12 next, under the presidency of Bert Boyd, of Los Angeles.

Facts Relative to Dental Advertising: There are 125 advertising offices in Southern California. There are 300 dentists engaged in the advertising practice in Southern California. There are 6,200 practicing dentists in the state. Approximately 7 per cent of young graduates are engaged in advertising practices. The following states prohibit the advertising of professional superiority or of the performance of professional services in a superior manner: Arkansas, Delaware, Illinois, Maryland, Minnesota, New York, Ohio, Oregon and Wisconsin. The following states prohibit the advertising of prices: Delaware, Illinois, Maryland, New York, Oregon and Wisconsin. Five states prohibit advertising by glaring light signs, or the use of advertising containing as a part the representation of a tooth, teeth, bridge work or any portion of the human head. Oregon and Illinois prohibit any advertising of any free dental services or examinations as an inducement to secure patronage. Twelve states provide as grounds for revocation of licenses the advertising of dental operations painlessly. Oregon is the only state that has a provision in the law prohibiting the advertising to guarantee a dental service.—(C. M. Benbrook, in *J. South. Calif. State D. Ass'n,* September, 1934.

Dr. Robinson Heads Dental Examining Board: Wilfred H. Robinson has been elected president of the National Association of Dental Examiners, comprising all the examining boards of the country.

Joint Meeting: At a joint meeting of the San Francisco District Dental Society and the San Francisco County Medical Society, September 4, the following dentists presented the program: Leland E. Carter, "Dental Radiographic Interpretation"; A. W. Ward, "Focal Infection"; and Henley Miller, "Aspects of Oral Surgery."

ILLINOIS

Active Membership Increase: As of Sept. 1, 1934, the total active membership

of the Chicago Dental Society was 2,010. This compares well with 1,861 at the same date last year, showing a general increase of 8 per cent. The total membership including associate and honorary members is 2,092.

52nd Annual Opening Exercises of the Chicago College of Dental Surgery: Recognition by the Royal College of Surgeons of England was announced by William H. G. Logan, dean, at the 52nd annual opening exercises of the Chicago College of Dental Surgery, Dental Department of Loyola University. Only eight other dental colleges in the United States have this recognition. Graduates of the Loyola dental school will be exempt from examinations in the basic sciences and will be admitted to the second and the final examinations on completion of a six months internship at a recognized English medical school and hospital, according to the terms of the recognition. This internship, which is required of all English dental school graduates, leads to the degree of licentiate in dental surgery. Congratulations and addresses of welcome to new students were presented at the convocation by the president, Samuel Knox Wilson, S. J., and C. N. Johnson, dean of students. Warren Willman delivered the principal address.

Dr. Gordon Addresses Societies: Samuel M. Gordon, secretary of the Council on Dental Therapeutics, addressed the Englewood Branch of the Chicago Dental Society, September 11, and the Southern Illinois Dental Society, September 21, on the work of the Council on Dental Therapeutics and the A.D.A. Bureau of Chemistry.

Dr. Gallie Guest Speaker in Ontario: Don N. Gallie, of Chicago, was the guest speaker at the annual dinner meeting of the Academy of Dentistry, Ontario, Canada, October 22. His subject was "Is Dentistry at the Crossroads?"

Campaign Against Impure Milk: State officials have launched a campaign against the sale of impure raw milk, which is now being dispensed at roadside stands and milk depots in Illinois, according to the *Chicago Tribune.* Efforts have been concentrated in suburbs outside Chicago, it was stated, where, in many cases, the milk depots do not come under the jurisdiction of municipal health authorities. It was pointed out that about 80 per cent of the depots investigated do not measure up to the sanitation standards of the state dairy and food division.

INDIANA

Exhibits at State Fair: Exhibits and demonstrations in the Good Health Building at the Indiana State Fair, September 1-7, were sponsored by the Indiana State Dental Association, the Indiana State Medical Association, the state hospital and tuberculosis associations and the Indianapolis College of Pharmacy.

MISSOURI

Dr. Smith Retires: Edgar W. Smith, of Kansas City, has announced his retirement and G. Farrell Webb will handle his practice.

NEBRASKA

Creighton Extension Courses: Father Thomas F. Bowdern, dean of the Graduate School of Creighton University, has announced the following: Students who have completed two full years of approved work of sixty-four semester hours and sixty-four quality points in the Creighton University College of Arts and Sciences, on recommendation of the college of arts and sciences and the college of dentistry, may receive the degree of bachelor of science in dentistry on the successful completion of the second year in the College of Dentistry of Creighton Universtiy.

NEW YORK

Dr. Wells Honored: June 15, Northwestern University Alumni Association presented an "Award of Merit" in recognition of significant civic, cultural and educational service to C. Raymond Wells.

Dentist on Education Board: Oscar Carrabine, New York City, was elected in July of this year to the presidency of the Board of Education of Mamaroneck Township, Westchester County.

Physicians and Allied Professions Political League, Inc.: This is an organization

formed for the purpose of representing the unified opinion of physicians, dentists and pharmacists. The organization will not try to change the political map but rather seek to obtain fair treatment from the political parties in power. Among the speakers at a recent meeting of the league were the following: Sen. J. J. Crawford of Kings County, sponsor of public health legislation; Walter T. Dannreuther, president of the New York County Medical Society; Harry Goldschmidt, Ph.G., president of the N. Y. Pharmaceutical Conference; John T. Hanks, secretary of the First District Dental Society; M. O. Magid, president of the Bronx County Medical Society; Nathan Van Etten, ex-president of the Medical Society of the State of New York. Charles N. Gelber is president of the organization.

Committee Name Changed: The name Joint Co-ordinating Committee of the First and Second District Dental Societies and the Allied Dental Council has been changed to "The Dental Commission of Greater New York."

Course in Dental Medicine: The fourth lecture course in dental medicine opens at Mount Sinai Hospital, October 9, with Ernst P. Boas as the speaker; subject, "Physical Diagnosis: Clinical Observations in Relation to Dental Conditions." The following complete the series: Samuel H. Geist, November 13, "Importance of Prenatal Care"; Harry Sobotka, Ph.D., December 11, "Chemistry of the Saliva and Its Influence on the Tissues"; Paul Klemperer, January 8, "Histopathologic Studies of the Dental Tissues"; Philip Finkle, February 12, "Arthritis and the Teeth"; Albert A. Berg, March 12, "Treatment of Oral Surgical Lesions from the Viewpoint of the General Surgeon"; Harry A. Goldberg, D.D.S., April 9, "Dental Infections, Their Significance and Treatment—Local and Systemic."

Dr. Koller Receives Medal of Honor: At the annual session of the American Academy of Ophthalmology and Otolaryngology held in Chicago, September 10-14, the academy's medal of honor was awarded to Carl Koller, of New York, who first introduced cocaine as a local anesthetic fifty years ago. In the absence of Dr. Koller, who was unable to attend because of illness, the medal was accepted by his daughter, Mrs. James Becker, Highland Park, Ill.

TEXAS

Bills Introduced: H. 55-XXX proposes to forbid the sale of barbituric acid "derivatives and compounds thereof under any copyrighted or chemical name," except on the prescription of a licensed physician. The proposed act is not to affect the sale of such drugs by wholesale drug houses to retail pharmacies or to physicians. A licensed physician is free to dispense these drugs, but apparently will be able to buy them from retail pharmacies only on prescription.

WASHINGTON

Membership:. The Washington State Dental Society has a greater membership so far this year than it has had for years. Their slogan is "Every Eligible Dentist a Member."

The Physicians and Dentists Credit Bureau, Inc.: The establishment of this Bureau in March was one of the progressive steps taken by the Seattle District Dental Society this year. Through the untiring efforts of the officers and a committee, an equitable agreement was reached with a like committee from the King County Medical Society whereby the two societies advanced a certain sum necessary to finance the organization until such time as the Bureau is on a self-sustaining basis. It is organized on business principles and embodies the experience of men engaged in credit and collection work. It is operated for the proper handling of accounts.

Dental Exhibit at Fair: A dental exhibit was presented at the Western Washington County Fair at Puyallup, September 17-23, under the auspices of the Tacoma District Dental Society. Enlarged drawings together with an amplified electrical transcription of the "talking tooth" were presented to the public with the aid of the Tacoma Dental Assistants.

State Meeting, 1935: The state dental meeting is to be held in Spokane next year. Those appointed to arrange for the meeting are: Drs. Mann, Olsen, Shanks, Lockard and Munsil, of Spokane.

WISCONSIN

Dr. Baumann on Examining Board: At the annual meeting of the National Association of Dental Examiners held at St. Paul in August, C. J. Baumann, a member of the Wisconsin State Board of Dental Examiners, was elected vice-president of the National Association, representing the west.

Report on Membership: Membership in the Wisconsin State Dental Society as of May 31, 1933, was 995, of which 596 had paid their dues for 1933, and 399 had not paid. Membership as of March 31, 1934, was 1,024, of which 792 had paid their dues for 1934, leaving 232 still owing for 1934 dues.

GENERAL

Shoe Companies Stop Using the Title "Dr.": Six shoe companies in New York and New England have signed agreements to discontinue misrepresentation in the sale of shoes, the Federal Trade Commission has announced. Complaints against the companies charged that all used the word "doctor" or abbreviation "Dr." in such manner as to lead buyers to believe the shoes were designed under a physician's supervision and contained special orthopedic features, the report stated.

Dentists in Congress: Only a few members of the dental profession have been elected to the Congress of the United States. In foreign countries, dentists are frequently members of parliament, especially in Latin American countries. The Senate includes in its membership only one dentist, Henrik Shipstead, Minnesota, now serving his second term, and only two physicians, Royal S. Copeland, New York, and Henry D. Hatfield, West Virginia. Senator Copeland is a Democrat and Senator Hatfield a Republican. Senator Shipstead is the sole representative of the Farm-Labor party in this branch of Congress, although there are several members of this party in the House of Representatives. Dentists in the House of Representatives include Frank Crowther, New York; R. O. Woodruff, Michigan; C. Murray Turpin, Pennsylvania, and John M. O'Connell, Rhode Island. All except Dr. O'Connell belong to the Republican party.

FOREIGN

Institute of Experimental Medicine: The government published a decree about the removal of the Institute of Experimental Medicine from Leningrad to Moscow. The architectural projects of the Institute's buildings are ready. They will be built in the style of the Italian renaissance. It is proposed to build stomatologic, pediatric and neuropsychiatric clinics, laboratories for physiology, morphology, biology, biochemistry and biophysics, a hall for 1,500 people for international congresses, a library consisting of 700,000 volumes, and other auxiliary buildings. About 100,000,000 rubles will be spent on the building of the institute during the second five year plan (1932-1937). When the buildings are finished, the Institute of Experimental Medicine will be the largest scientific and practical medical establishment in the world.—*J.A.M.A.,* Sept. 8, 1934.

Dental Publications Consolidated: In an effort to reduce the number of dental publications, a consolidation of the *Vierteljahrsschrift fur Zahnheilkunde, Fortschritte der Orthodontik* and *Deutsche Kieferchirurgie* has been effected, the periodical appearing as *Deutsche Zahn-, Mund und Kieferheilkunde,* a monthly. The issue has 64 pages and contains only a small amount of advertising, not included in the pages listed. The editor-in-chief is E. Wannenmacher, Tubingen. Surgery of the jaws and orthodontia will occupy three issues yearly under the supervision of Drs. Axhausen, Berlin, and Korkhaus, Bonn. The first issue contains forewords by Euler, Axhausen, Korkhaus and Wannenmacher, and four articles: "Focal Infection, Its Diagnosis, Therapy and Prophylaxis," by P. Adloff, Konigsberg; "Treatment of Fractures of the Neck of the Mandible in Children," by C. Krohn, Copen-

hagen; "Broken and Dislocated Condyle," by E. Reichenbach, München; Histologic Research—Results on the Question of the Innervation of Human Teeth, by J. Münch, Würzburg. A letter announcing the launching of the journal says the treatment of general dental questions such as conservational dentistry, prosthesis, materials, paradental therapy and pathology, will have first consideration.

Deaths

Andrade, Alexander, New York City; Temple University School of Dentistry, 1898; died, August 14.

Chambers, Elmer Ellsworth, Warren, Ohio; Western Reserve University, School of Dentistry, 1902; died, September 4.

Cross, C. E., Red Cloud, Nebr.; died, May 31.

Corley, G. F., Mattoon, Ill.; Chicago College of Dental Surgery, 1902; died, September 28.

Doran, Richard, New York City; New York College of Dentistry, 1893; died, August 20.

Gage, Glen A., Milwaukee, Wis.; Marquette University, School of Dentistry, 1913; died, July 27.

Gossard, A. E., Kansas City, Mo.; Western Dental College, 1900; died, July 21.

Malin, Harold V., Iron Mountain, Mich.; University of Michigan, College of Dental Surgery, 1923; died recently; aged 37.

Rouse, A. G., New York City; New York College of Dentistry, 1887; died, June 21.

Sherman, Samuel I., Brooklyn, N. Y.; New York College of Dentistry, 1907; died recently.

Spies, William F., New York City; University of Michigan, College of Dental Surgery, 1902; died, August 10.

MISCELLANY

BOOK REVIEWS

Studies in the Masticatory Movements of the Human Lower Jaw. By G. Y. Hildebrand. Published by Walter De Gruyter and Co., Berlin and Leipzig, 1931.

Hildebrand acknowledges the thoroughness with which this subject has been studied by prosthetists. In the literature, the prevailing view of the masticatory movement is that mastication ends with the grinding movement. Some authors are doubtful regarding the lateral movement. The author divides the process of mastication as follows: (1) the seizing of the food, including the biting off process; (2) the actual mastication, and (3) the swallowing. Actual mastication is the basis of his studies. He limits his problem to the movement of the points infradentale and the condyle crest in adults with complete natural dentures while masticating various kinds of food. The problem is approached from a purely theoretical point of view—the opposite of the attack of previous authors. The problem is the primary matter, its application secondary. The report comprises 190 pages, forty of which are devoted to cuts and schema, twenty-four to tables and four to bibliography. The minuteness of the study makes it understandable only to one intimately versed in craniometry. It is doubtful that the most skilful prosthodontist would find aid or illumination in it. Whatever its merit as a fine-spun elaboration of scientific effort, it has far to go to reach the language and craft of the makers of dentures, the ultimate objective of all such studies.

Climate and Civilization and Their Influences on the Human Body and Teeth. By F. W. Proell, Berlin, 1934.

The author attempts in this book of 138 pages and fifty-nine illustrations to present a scientific research as to how climate and civilization influence the body and teeth. Since changes in metabolism and pathologic

influences leave marks on the teeth, they may also serve as test organs for hereditary and environmental influences as far as climate and civilization influence the health of the human body and its individual organs, especially the teeth. In Part I, the author discusses the geographic and environmental influences of the inhabitants of South Africa as to their birth problems, bringing up of children, diet, clothing, water supply, care of the body and health. Part II deals entirely with dentition. Everything of importance from an anthropologic and biologic point of view is discussed. The chapters in this part are on the skull, jaws, teeth and lips; the biting apparatus; anomalies; bite reduction; irregularities of teeth; bite anomalies; wear of teeth; paradentosis, failure of calcification and enamel hypoplasia; formation and spread of caries, and comparison of these conditions with similar conditions in white children. The important part in the chapter on caries is the statement that caries is not a hereditary degeneration, as, it is asserted, caries frequency among the modern Eskimo is very high. The book is very interesting from every point of view.

CORRESPONDENCE

Dental Education in Europe: A Correction

To the Editor:

My attention has been called to an erroneous impression that I unintentionally conveyed in an address published in the August, 1933, issue of The Journal wherein I said: "In Europe, dental practitioners consist of two classes: doctors of medicine and dental technicians. The latter do most of the dental work done in Europe, but they have as a rule little dental education."

I find that I was in error in assuming that there was no distinction between the regulations in the different countries of Europe, each of which has requirements distinctive in itself, just as we have in the different states of our own country.

There was no intent on my part to reflect in any way on the distinguished men who form the bone and sinew of the dental profession of Europe, among whom I have many friends and whose regard I cherish most highly.

If I, in my remarks, seemed to cast undue reflection on certain groups of men in Europe, I can only say that this was due to a misconception or misinformation on my part, and that I am truly sorry. I would be the last man to contribute in any way to lack of the most perfect understanding between the professions of Europe and America. I hold in the highest esteem the fine men who are laboring so faithfully for the uplift of dentistry in the various countries of Europe, and I unite with them in the fervent hope that the essence of goodfellowship and confraternity shall always obtain on both sides of the water.

G. Walter Dittmar, *Past President,*
American Dental Association.

RESOLUTION OF STATE OF NEW JERSEY BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY

Resolved, that on and after June, 1937, this Board will accept as candidates, graduates of only the following dental schools: College of Dentistry, Howard University; College of Dentistry, University of Illinois; Harvard University Dental School; Tufts College Dental School; New York University, College of Dentistry; School of Dental and Oral Surgery of Columbia University; School of Dentistry, University of Buffalo; School of Dentistry, Western Reserve University; College of Dentistry, Ohio State University; University of Pennsylvania Dental School; Dental Department, Meharry Medical College, and that additional dental schools from time to time be either added or deleted from this list by action of the Board, as circumstances may dictate.

RECOMMENDATIONS OF COMMITTEE ON ECONOMICS

The Committee on Economics recommends that every state or component society have a committee on economics.

The members of these committees should be men who are particularly interested in the economic welfare of their profession and who are willing to devote time and

effort to help solve the complicated problems now confronting organized dentistry.

The state economic committees are expected to assist in forming similar groups within the district, county or local societies of their respective states. The latter groups will keep in close touch with their state committee in all matters that may concern the commonwealth.

A state committee will report to the members of the A.D.A. Committee on Economics who may be in charge of the district in which the state is located. In some instances, this committeeman may appoint a state deputy to assist him in the work of coordination. In that case, the state society will work through this deputy.

It is desired to make contacts with all members of Congress and legislatures, to explain to them that the dental and medical professions wish to cooperate in conditions brought about by the times, in supplying medical and dental care to the people and ask the privilege of being officially represented in all conferences that have to do with public health problems.

Please report promptly all activities along these lines to the Secretary of the Committee on Economics, American Dental Association, 212 East Superior St., Chicago, Ill.

The members of the committee and the district which each represents are as follows: 1. Maurice E. Peters, Boston, Mass.; 2. John T. Hanks (vice chairman), New York City; 3. A. C. Van Kirk, Bellevue, Pa.; 4. E. J. H. Schneider, Maplewood, N. J.; 5. C. J. Caraballo, Tampa, Fla.; 6. R. H. Miller, St. Louis, Mo.; 7. E. E. Voyles, Indianapolis, Ind.; 8. H. W. Oppice, Chicago, Ill.; 9. M. W. Prince, Detroit, Mich.; 10. L. M. Fitzgerald, Dubuque, Iowa.; 11. E. H. Bruening (chairman), Omaha, Nebr.; 12. W. O. Talbot, Fort Worth, Texas; 13. L. R. Packwood, Fresno, Calif.; 14. C. T. Messner, United States Public Health Service, Washington, D. C., 15. Lon W. Morrey (secretary), Chicago, Ill.

E. H. Bruening, *Chairman,*
City Nat'l Bank Bldg.,
Omaha, Nebr.

Oct. 9, 1934.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, New Orleans, La.

American Dental Society of Europe, London, July 31-August 3.

Belgian National Dental Congress, Brussels, August.

Dental Protective Association of the United States, Chicago, December 17.

Midwinter Clinic of the Chicago Dental Society, February 18-21.

National Board of Dental Examiners, January 11-12; May 24-25.

New York Dental Centennial, New York City, December 3-7.

Odontological Society of Western Pennsylvania, Pittsburgh, Pa., November 7-9.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

STATE SOCIETIES

November
Connecticut, at New Haven (14)

February
Minnesota, at Minneapolis (26-28)

April
Mississippi, at Jackson (22-24)

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of The Journal.

May
Illinois, at Quincy (14-16)

June
New York, at Upper Saranac (12-15)

STATE BOARD OF DENTAL EXAMINERS

California, at San Francisco, December 3. K. I. Nesbitt, 450 McAllister St., San Francisco, Secretary.

Colorado, at Denver, December 4-8. N. C. Gunter, Pueblo, Secretary.

Connecticut, at Hartford, November 21-24. Almond J. Cutting, Southington, Secretary.

Delaware, at Wilmington, January 23-24. W. S. P. Combs, Middleton, Secretary.

Indiana, at Indianapolis, October 29-November 2. J. M. Hale, Mt. Vernon, Secretary.

Iowa, at Iowa City, December 17-20. Hardy F. Pool, Mason City, Secretary.

New Jersey, at Trenton, December 3-8. John C. Forsyth, 148 W. State St., Trenton, Secretary.

Pennsylvania, at Philadelphia and Pittsburgh, December 4-8. W. A. McCready, 1115 Highland Bldg., Pittsburgh, Secretary.

Rhode Island, at Providence, December 4-6. Albert L. Midgley, 1108 Union Trust Bldg., Providence.

Wisconsin, at Milwaukee, December 10-14. S. F. Donovan, Tomah, Secretary.

DENTAL PROTECTIVE ASSOCIATION OF THE UNITED STATES

The annual meeting of the Dental Protective Association of the United States will be held at the Palmer House, Chicago, December 17, at 4 p.m. The report of the officers will be given, a board of directors will be elected and such other business transacted as should come before the association. All members are urgently requested to be present.

By order of the Board of Directors,

E. G. Snodgrass, *President,*
D. M. Gallie, *Vice Pres.-Treas.*
E. W. Elliot, *Secretary.*

NATIONAL BOARD OF DENTAL EXAMINERS

The National Board of Dental Examiners (organized under the authority of the American Dental Association) will hold examinations in Parts I and II on the following dates: Friday, January 11, and Saturday, January 12; Friday, May 24, and Saturday, May 25, in any approved dental school requesting them, provided there are five or more candidates. In cities where two or more dental schools are located, the examinations for all candidates will be held in a single institution, and thereafter rotated among such schools as have qualified candidates. For further information, application blanks, etc., address

Morton J. Loeb, *Secretary,*
66 Trumbull St.,
New Haven, Conn.

COLORADO STATE BOARD OF DENTAL EXAMINERS

The next regular meeting of the Colorado State Board of Dental Examiners will be held December 4-8, at Denver. For further information, apply to

N. C. Gunter, *Secretary,*
Pueblo.

PENNSYLVANIA STATE BOARD OF DENTAL EXAMINERS

The Pennsylvania State Board of Dental Examiners will hold its next examinations December 4-8, at Philadelphia and Pittsburgh.

W. A. McCready, *Secretary,*
1115 Highland Bldg.,
Pittsburgh.

RHODE ISLAND BOARD OF REGISTRATION IN DENTISTRY

A meeting of the Rhode Island Board of Registration in Dentistry for the Examination in Dentistry for the examination of applicants for license to practice dentistry and dental hygiene will be held at the State House, Providence, December 4-6, beginning each day at 9 a.m. Candidates shall present to the secretary of this board, at least ten days before the examination, an application with fee and photo-

graph. For applications and further information, address

ALBERT L. MIDGLEY, *Secretary,*
1108 Union Trust Bldg.,
Providence.

MIDWINTER CLINIC OF THE CHICAGO DENTAL SOCIETY

The Midwinter Clinic of the Chicago Dental Society will be held February 18-21 at the Stevens Hotel, Chicago.

CARROLL W. STUART, *Secretary,*
108 N. State St.,
Chicago.

NEW YORK DENTAL CENTENNIAL

The New York Dental Centennial will be held at the Hotel Pennsylvania, New York City, December 3-7, in commemoration of the organization of the first dental society in the world. Appearing on the general program are E. C. Rosenow, of the Mayo Clinic; James C. Healy, Tufts College Dental School; Martha Jones, Hawaii; Frank M. Casto, Cleveland, Ohio; Thomas Parran, New York City; Homer C. Brown, Columbus, Ohio, and Harlan H. Horner, assistant commissioner of higher education of the State of New York. The Detroit Clinic Club has accepted an invitation to appear. There will be prize essays, section meetings and registered clinics; historical, art, scientific and hobbies exhibits, pharmaceutic and manufacturers' exhibits. For entertainment, a historical pageant will be staged by professional and amateur talent. This is to be the largest meeting ever held in New York.

GEORGE C. DOUGLASS,
for the Executive Council.

DENTAL SOCIETY OF THE STATE OF NEW YORK

The Dental Society of the State of New York will hold its 67th annual meeting June 12-15, at Saranac, Inn, Upper Saranac. For further information, address

A. P. BURKHART, *Secretary,*
57 E. Genesee St.,
Auburn, N. Y.

CONNECTICUT STATE DENTAL ASSOCIATION

The eighth annual mid-season meeting of the Connecticut State Dental Association will be held at the Medical Bldg., New Haven, November 14.

C. W. VIVIAN, *Secretary,*
58 Elbridge Rd.,
New Britain.

MINNESOTA STATE DENTAL ASSOCIATION

The fifty-second annual meeting of the Minnesota State Dental Association will be held in the Municipal Auditorium, Minneapolis, February 26-28.

L. M. CRUTTENDEN, *Secretary,*
1353 Lowry Bldg.,
St. Paul.

MISSISSIPPI DENTAL ASSOCIATION

The next meeting of the Mississippi Dental Association will be held at Jackson, April 22-24, at the Robert E. Lee Hotel.

M. L. JONES, *Secretary,*
Meridian.

VACANCIES ON DENTAL STAFF OF BRONX HOSPITAL

There will be a number of vacancies on the dental staff of the Bronx Hospital, Bronx, N. Y., open to members of the dental profession who are devoted to institutional practice and interested in the medical phase of dentistry as it can best be studied in conjunction with a medical faculty in a hospital. In addition to the outpatient department, ward cases receive dental care. Here, the dental department in cooperation with physician, surgeon and pathologist studies the results of focal infection. Application for joining the staff should be made to

DAVID WURZEL, *Chief of Clinic,*
The Bronx Hospital,
Fulton Ave. & 169th St.,
Bronx, N. Y.

LIBRARY BUREAU
AMERICAN DENTAL ASSOCIATION
OFFERS YOU

(1) The Dental Creed

Copies of the creed are available in form suitable for framing from the Library Bureau of the American Dental Association, 212 E. Superior St., Chicago, at 50 cents each. They are 10 by 15 inches and are printed on high grade paper in brown ink. The initial letter may be obtained in red or green, as preferred. Each copy is signed by the author. This creed appeared as an editorial in the August, 1934, issue of The Journal. Kindly send remittance with order.

(2) Written Instructions for Your Denture Patients

A fourth printing of "Your New Teeth," a booklet for denture patients, has just come off the press. This booklet is intended primarily for the patient who is wearing dentures for the first time. It enumerates some of the difficulties that may be encountered when one first wears dentures and offers suggestions as to how these difficulties may be overcome. There is also in the booklet much regarding the care, repair and rebasing of dentures that is of interest to the patient who has been wearing dentures. The information in "Your New Teeth" was taken from the article entitled "Instructions for the Edentulous Patient," by B. L. Hooper, which was published in The Journal, February, 1932. The price of these booklets is: 25, $1.00; 50, $1.50; 100, $2.00. Kindly send remittance with order. A sample booklet will be sent on request.

(3) Printed List of Recent Books

A list of the books in the Library published since 1925 and available for circulation will be mailed free on request. Most of the books on this list were included in the list printed in The Journal, June, 1934.

(4) Printed List of Package Libraries

Package libraries on nearly 300 phases of dentistry have been compiled. These packages each contain from ten to sixty articles, averaging about twenty. The rental fee for a package is 50 cents. The printed list contains about the same headings as appeared in the list published in The Journal, May, 1934. A copy of this list will be mailed on request without charge.

(5) Orthodontia Editorial

A few more copies of the tribute to orthodontia, which originally appeared as an editorial, may be obtained. This editorial is reprinted in form suitable for framing, on good quality paper, measuring 10 by 15 inches. The print is brown with the initial in green or red, as preferred. The editorial is signed in brown by the author. The cost per copy is 50 cents. Send your order and remittance to the Library Bureau.

Please send me

_____

for which I enclose $_____

Name_____

Street_____

City_____ State_____

OFFICERS AND TRUSTEES OF THE AMERICAN DENTAL ASSOCIATION
1934-1935

PRESIDENT

Frank M. Casto.....1336 B. F. Keith Bldg., Cleveland, Ohio

PRESIDENT ELECT

George B. Winter.....Frisco Bldg., St. Louis, Mo.

VICE PRESIDENTS

Max E. Ernst.....1252 Lowry Bldg., St. Paul, Minn.
B. F. Thielen.....Paris, Texas
Frederick H. Lum, Jr.....151 Main St., Chatham, N. J.

SECRETARY

Harry B. Pinney.....212 E. Superior St., Chicago, Ill.

TREASURER

R. H. Volland.....First Capitol Nat'l Bank Bldg., Iowa City, Iowa

BOARD OF TRUSTEES

Frank M. Casto, President, Ex-Officio...1336 B. F. Keith Bldg., Cleveland, Ohio
George B. Winter, President Elect, Ex-Officio.....Frisco Bldg., St. Louis, Mo.
Harry B. Pinney, Secretary, Ex-Officio.....212 E. Superior St., Chicago, Ill.
R. H. Volland, Treasurer, Ex-Officio.....
.....First Capitol Nat'l Bank Bldg., Iowa City, Iowa
J. G. Hildebrand, '37.....Waterloo, Iowa
Albert R. Ross, '37.....Murdock Bldg., Lafayette, Ind.
Oren A. Oliver, '37.....Medical Arts Bldg., Nashville, Tenn.
Harvey J. Burkhart, '36.....Box 879, East Avenue P. O., Rochester, N. Y.
C. R. Lawrence, '36.....730 Bass Bldg., Enid, Okla.
Herbert C. Miller, '36.....E. 6th and Oregon Sts., Portland, Ore.
W. H. Robinson, '36.....American Bank Bldg., Oakland, Calif.
Harry Bear, '35.....410 Professional Bldg., Richmond, Va.
C. Willard Camalier, '35.....1726 Eye St., N. W., Washington, D. C.
Thomas L. Grisamore, '35.....29 E. Madison St., Chicago, Ill.
E. G. Meisel, '35.....121 University Place, Pittsburgh, Pa.
Marcus L. Ward, '35.....1308 Cambridge Road, Ann Arbor, Mich.

Ohio

Mo.

Minn.
Texas
N. J.

o, Ill.

Iowa

Ohio
, Mo.
o, Ill.
....
Iowa
Iowa
, Ind.
Tenn.
N. Y.
Okla.
, Ore.
Calif.
d, Va.
D. C.
o, Ill.
h, Pa.
Mich.